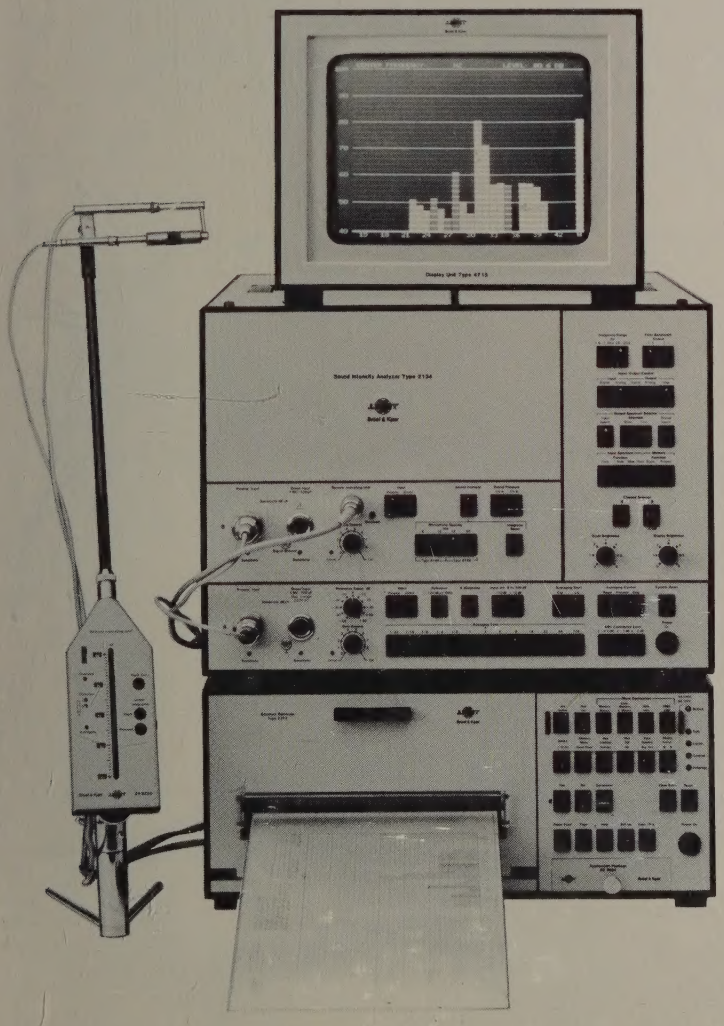
2313
BZ 7004

Instruction Manual

Graphics Recorder Type 2313
plus Application Package BZ 7004



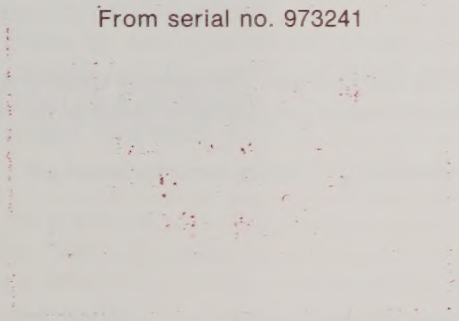
A highly versatile alphanumeric printer and graphics recorder for use with digital measuring and analysing equipment furnished with an IEC/IEEE interface. Together with Application Package BZ 7004 it offers fast, fully annotated graphic plots of measured 1/1 and 1/3 octave frequency spectra as presented on the display screen of the B&K Sound Intensity Analysing System Type 3360 and the Digital Frequency Analyzer Type 2131 in as little as 10 seconds. Also a variety of special tasks can be performed such as storage of measurement results, reformatting of data for amplitude/frequency-/distance "3-D" plots, amplitude / frequency contour plots, sound power calculations, sum, difference etc., plus 4-pass 1/12 octave analysis and 1/12 octave source location. For use with other B&K measuring and analysing equipment, the 2313 may be fitted with a range of other Application Packages.

Brüel & Kjær

PROPERTY OF DEPT. C1-258
METROLOGY LAB.
DO NOT REMOVE
FROM AREA

GRAPHICS RECORDER TYPE 2313
PLUS
APPLICATION PACKAGE BZ 7004

From serial no. 973241



November 1985

SAFETY CONSIDERATIONS

This apparatus has been designed and tested according to Class II of IEC Publication 348, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in safe condition. The present Instruction Manual contains information and warnings which should be followed by the user to ensure safe operation and to retain the apparatus in safe condition. Special note should be made of the following:

APPLICATION OF POWER

Before each use of the apparatus, check that it is set to match the available mains voltage and that the correct fuse is installed.

SAFETY SYMBOLS

⚠ The apparatus will be marked with this symbol when it is important that the user refer to the associated warning statements given in the Instruction Manual.

⊥ Chassis terminal ⏚ Safety earth terminal ⚡ Hazardous voltage

WARNINGS

Whenever it is likely that the correct function or operating safety of the apparatus has been impaired, the apparatus must be made inoperative and be secured against unintended operation.

Any adjustment, maintenance and repair of the open apparatus must be avoided as far as possible and, if unavoidable, must be carried out only by trained service personnel.

CONTENTS

1. INTRODUCTION AND SPECIFICATIONS (Product Data) 1

2. CONTROLS 5

2.1. Front Panel 5
2.2. Rear Panel 11

3. PRELIMINARY 13

3.1. ENVIRONMENT AND HANDLING 13
3.2. BENCH AND RACK MOUNTING 13
3.3. CONNECTION OF MAINS SUPPLY 13
3.4. CONNECTION OF CONTINUOUS MEMORY SUPPLY 14
3.5. GROUNDING CONSIDERATIONS 15
3.6. INSTALLATION OF APPLICATION PACKAGE 16
3.7. PAPER LOADING AND CLEANING OF PRINT HEAD, RUBBER ROLLER & SPINDLES 17
3.8. USE OF RESET AND SELF–TEST 19
Reset 19
Self-Test 20
3.9. SET–UP PROCEDURE 21
Setting the Clock 24
Selecting a Set–Up 26
Selecting a Function 27
Selecting Parameter and Parameter Value(s) 28

4. USE WITH SOUND INTENSITY ANALYSING SYSTEM TYPE 3360, DIGITAL FREQUENCY ANALYZER TYPE 2131 AND DIGITAL CASSETTE RECORDER TYPE 7400 31

4.1. BASIC ANALYSIS AND RECORDING SET–UP 31
4.2. CONTROL FUNCTIONS 33
List [0] – Function No: 0 33
Plot [1] – Function No: 1 37
Move to Memory [2] – Function No: 2 41
Move to Continuous Memory [3] – Function No: 3 44
Move to 7400 [4] – Function No: 4 46
Move to 3360 [5] – Function No: 5 48
Delete [6] – Function No: 6 50
Memory Menu [7] – Function No: 7 53
Plot Contour [8] – Function No: 8 54
Plot 3D [9] – Function No: 9 59
Input Spectra [–] – Function No: 10 64
1/12 Oct. Source Location [/] [1] – Extended Function No: 11 71

Modify Spectrum [/] [2] – Extended Function No: 12 72
Edit Surface [/] [3] – Extended Function No: 13 74
1/12 Octave [6] – Sub Function No: 16 75
Sound Power [7] – Sub Function No: 17 79
Subtract Spectra [8] – Sub Function No: 18 85
Add Spectra [9] – Sub Function No: 19 86
Surface [0] – Sub Function No: 20 87
7400 File to BZ 7004 File [24] – Function No: 24 87
Multi Subtract [/] [18] – Extended Function No: 28
Multi Add [/] [19] – Extended Function No: 29 89
Personal Text [/] [100] – Extended Function No: 110 90
Execute 7400 Program – Extended Function No: 111 92
Store 7400 Program – Extended Function No: 112 92
Execute Sequence [/] [103] – Extended Function No: 113 93
Enter Sequence [/] [104] – Extended Function No: 114 93
Edit Sequence [/] [105] – Extended Function No: 115 97
Shift Function [/] [106] – Extended Function No: 116 98
Wait [/] [107] – Extended Function No: 117 100
Wait Clock [/] [108] – Extended Function No: 118 100
Relay On [/] [110] – Extended Function No: 120;
Relay Off [/] [111] – Extended Function No: 121 101
Last [1]–Sub Function No:1 102

4.3. COMMON SET-UP 103
Print Lin and A – Common Function No: 200 103
Contour, 3D-expand – Common Function No: 201 104
Contour, 3D-plot – Common Function No: 202 108

4.4. ERROR CODES 110

4.5. WARNINGS 113

5. USE WITH OTHER DIGITAL FREQUENCY ANALYZERS 114

6. DATA TRANSFER OVER THE IEC INTERFACE 115

6.1. INTRODUCTION 115

6.2. IEC FUNCTIONS IMPLEMENTED 115

6.3. ADDRESSING THE TYPE 2313 116
Setting the Address Switches 117

6.4. MODES OF OPERATION 118
Listen Only Mode 118
Remote/Local Operation 118

6.5. THE INTERFACE JOB 118

6.6. JOBS IN THE BZ 7004 119
Default 120
Function 120
Master 122
Newsetup 122
Page 123
Printer 123
Repeat 124
Returnadr 124
Setup 125
Showtime 126
SRQenable – SRQdisable 127
Test 127

Text0 – Text4 128
Toppage 128
6.7. CHECKING THE JOB SPECIFICATION 129
6.8. CHECKING FOR JOB ERRORS 129
6.9. ERRORS BY REMOTE CONTROL 129
6.10. POLLING THE STATUS OF THE 2313 130
6.11. CLEARING THE 2313 VIA THE BUS 130
6.12. PRINTING WITH THE 2313/BZ 7004 131
Changing the Printer Format in the "Printer" Mode 133
Changing to the "Graphic" Mode 134

7. RS 232C SERIAL INTERFACE 137

7.1. INTRODUCTION 137
Setting the 2313 Baud Rate 138
Personal Text 139
Remote Control of the 2313 Front Panel 140

8. SERVICE AND REPAIR 141

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_09836

Graphics Recorder

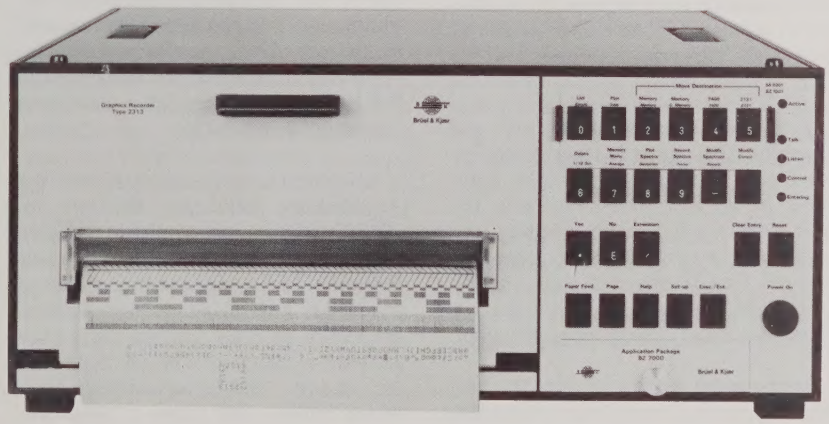
USES:

- Dot-matrix printer for plotting measured spectra presented on the display screen of B&K digital measuring or analyzing instrumentation, plus documenting front panel control settings etc.
- Versatile system controller for instruments equipped with IEC/IEEE digital interface bus
- Digital recorder for storage of spectra and front panel control setting data
- Reformatting of data for new types of measurement. Extends measurement capability of B&K equipment

FEATURES:

- High-resolution graphic and alphanumeric print out using fixed 512 point print head with 0,2 mm step paper feed
- Accepts 210 mm wide rolls of metallized paper. One 50 m roll equivalent to 160 A4 charts
- 96 standard and 32 special alphanumeric characters according to ISO 646 and 2022 standards
- Range of plug-in Application Packages available to suit the individual documentation and measurement needs of B&K measuring and analyzing equipment
- Built-in crystal controlled clock for print out of date and time together with measurement results
- Continuous and volatile memories for storage of measurement spectra
- Choice of Operating Set-Ups for specifying type of print out, memory allocation and measurement functions etc.
- Simple, easy to follow pushkey operation, plus extensive "Help" file for step by step guidance of first time users

Introduction



The Graphics Recorder Type 2313 is a highly versatile alphanumeric and graphics printer for use with B&K digital measuring and analyzing instrumentation equipped with an IEC interface bus. Together with an appropriate Application Package it offers fast, fully annotated, graphic plots of frequency spectra, time functions etc., as presented on the display screen of B&K instruments. In addition, it may be employed as a conventional alphanumeric/graphics printer for documenting data transmitted by other digital equipment furnished with an IEC or IEEE interface.

Besides documentation of data, the 2313 is capable of performing a variety of other important tasks for which extra equipment would normally be required. Using its continuous and volatile memories, for example, several hundred complete measurement spectra can be recorded and stored for future print out or transmission to other equipment. Also, new types of measurement can be generated from stored and incoming data, plus use as a system controller is possible. Thus, whatever measuring instrumentation is employed, the 2313 opens up a whole new range of measurement possibilities and applications.

Description

Writing System

The writing system of the 2313 accepts 210 mm wide rolls of electrosensitive paper QP 4690. Two 50 m rolls are supplied with the Recorder, each providing the equivalent of 160 A4 (metric) size charts. The paper is of the readily available metallized type and produces clear well defined print that is not susceptible to fading as with chemically treated types.

When loaded in the 2313, the metallized surface of the paper contacts a fixed, single-element, print head. This is accessible via the paper outlet slot on the front panel to facilitate easy cleaning and to achieve a high resolution print has 512 individual electrodes. These are spaced at 0,4 mm intervals and span almost the complete paper width giving a maximum line width of 205 mm.

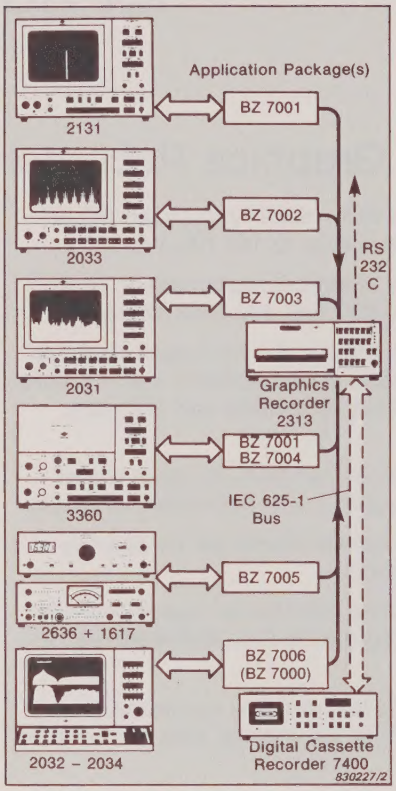


Fig. 1. Interchangeable Application Packages for use of different Digital Frequency Analyzers with the 2313

For well formed characters and graphics, the paper is evenly accelerated and decelerated past the print head in 0,2 mm steps. Utilizing the plot mode for 512-point graphics, the maximum print rate is 46 lines per second. Due to the relatively smooth transition from one line to the next, relatively quiet operation is obtained.

In the print mode a total of 96 standard upper and lower case characters may be called on, plus 32 special characters. These are according to ISO 646 and 2022 standards respectively, and are based on a 6 by 8 point matrix. For enhancing different text four character sizes up to 12,8 mm may be chosen, which enable between 46 and 85 characters per line to be printed. In addition line spacings between 0,4 and 2,8 mm may be selected. The print rate depends on the size and number of characters printed and is between 3 and 9 lines per second.

If required text and graphics can be mixed by changing from the print to plot mode (or vice versa) at the start of a new line. Text and graphics may also be justified to the left or right margin of the paper and for filing in standard binders there is a "Page Feed" function for advancing the paper the remainder of one A4 or 11 inch chart.

Application Packages

As standard the Application Package BZ 7000 is included with the 2313. This plugs directly into a port on the front of the Recorder and facilitates use of the 2313 as a conventional alphanumeric/graphics printer as well as permits direct copying of spectra presented on the display screen of the B&K Dual Channel Signal Analyzers Types 2032 and 2034.

Also for use with the 2313 are the Application Packages BZ 7001 to BZ 7006. These are available as extra and especially convert the 2313 to suit the individual documentation needs of the B&K Digital Frequency Analyzers shown in Fig. 1. Furthermore they provide a range of special functions for storage and reformatting data, which enable new types of measurement to be made using the analysis equipment shown.

Note: For direct copying of measurements presented on the display screen of the B&K Dual Channel Signal Analyzers Types 2032 and 2034, any Application Package may be employed, including BZ 7000.

Documentation

Common to all Application Packages, except BZ 7000, are "List" and "Plot" functions. Both are selectable using the pushkeys of the Recorder and provide fully annotated, hard-copy documentation of measured frequency spectra and/or time domain functions in as little as 10 seconds. Examples of the two types of documentation are shown in Fig.2 and 3 respectively. Generally graphic plots of spectra resemble those presented on the display screen of B&K Digital Frequency Analyzers, except that they also have fully annotated measurement axes and include front panel control setting information plus the date and time of the readout.

If desired two separate spectra can be plotted simultaneously. Also, documentation may be modified to suit the specific signal analyzed. The latter is accomplished by selecting any one of three independent "Operating Setups" stored in the Recorder. These provide access to the different control functions of the particular package employed, permitting the user to change or select individual control parameters using the pushkeys of the Recorder. For example, different amplitude axes and offsets may be chosen or autoranged to correspond with the maximum signal level, only data within a user-defined frequency

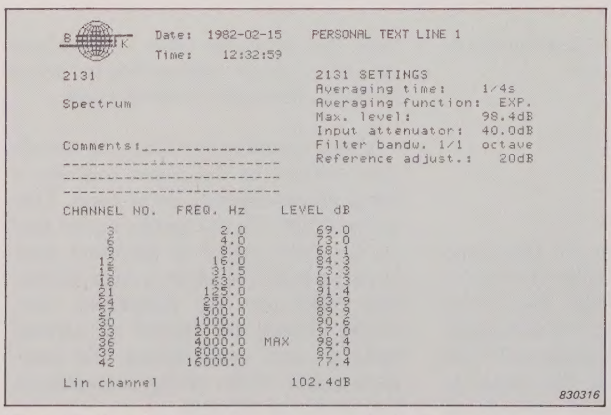


Fig.2. Typical listing of 1/1 octave analysis data, printed by the 2313 Graphics Recorder with Application Package BZ 7001

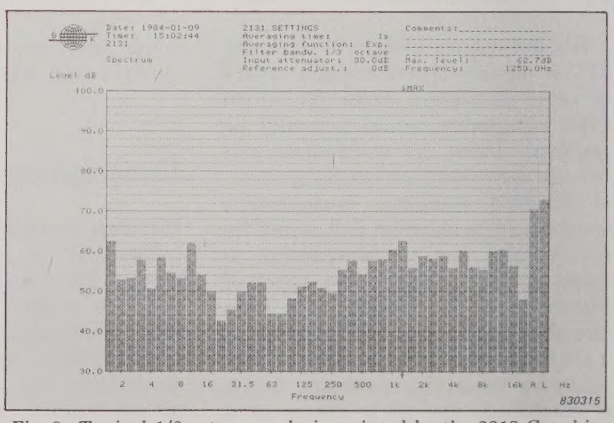


Fig. 3. Typical 1/3 octave analysis, printed by the 2313 Graphics Recorder with Application Package BZ 7001

range printed, and measurement axes graduated directly in dB and Hz or standard engineering units of Pa, ms^{-2}, mV etc.

Storage

The 2313 includes both continuous and volatile memories. These enable measured spectra and other data transmitted by particular equipment for which the Application Package is designed, to be individually filed during the course of measurements. Stored spectra may then be recalled at some other time for comparison with later incoming data or may be saved and reformatted for new types of measurement.

With the continuous memory approximately ten sets of complete spectra may be stored, whilst with the volatile memory storage of several hundred sets is possible (see Specifications). Also, a 100 step pushkey sequence can be entered, enabling a whole series of measurement, storage and documentation functions to be carried out completely automatically. For identification and quick location of data, a "Memory Menu" function can be activated which lists file numbers along with other main data concerning stored measurements.

To help safeguard stored data, special provision is made for securing consecutive memory files. Whereas the volatile memory is intended only for temporary storage, data stored in the continuous memory can be retained more-or-less indefinitely provided that the 2313 is subjected to regular use.

Measurements

An important feature of the 2313 is that it is capable of reformatting stored and incoming spectra, enabling new types of measurement to be documented, without having to use or especially program other equipment for the purpose.

The different types of measurement available cover production of sum, difference and average spectra, sound contour and 3D plots, 3-parameter (amplitude/frequency/time) mapping of single events etc. Furthermore, 1/1 or 1/3 octave spectra may be assembled from narrow-band data transmitted by Frequency Analyzers Types 2031 and 2033, or a 1/12 octave – 4 pass analysis carried out in conjunction with Frequency Analyzer Type 2131. See Fig.4 and Specifications.

Stored spectra may also be individually modified using the pushkeys of the Recorder. This is valuable for eliminating unwanted components, as well as for generating different reference spectra for comparison with incoming data.

Built-in Clock

All internal operating sequences are governed by a built-in clock generator. For data logging purposes there is a calendar function enabling both date and time to be automatically recorded at the head of each data file stored or documented with the Recorder. If need be the clock may be set to initiate a series of readouts at preselected intervals ranging from 1s to 24 hours, and/or start a control sequence after both a preset level and time have been

Fig. 6. Alphanumeric characters available with the 2313 Graphics Recorder

exceeded. This is useful in airport noise surveys, machine surveillance for preventive maintenance etc.

Digital Interface and System Control

System control, plus digital input and output of measurement data, takes place via the IEC/IEEE Interface of the 2313. This enables a large number of instruments with compatible interface to be connected directly on-line with the Recorder. However, where more than digital input of data and manual operation of the measuring system is required, the 2313 must be fitted with an Application Package other than BZ 7000.

A notable feature of the Application Packages BZ 7001 to BZ 7006, is that they permit all information transfer over the IEC /IEEE bus of the measuring system to be governed by the

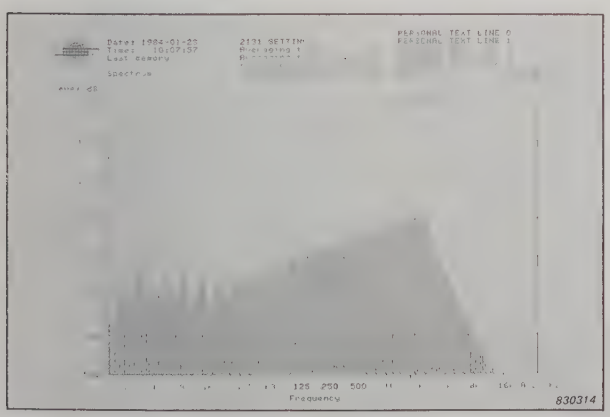


Fig. 4. Typical 1/12 octave – 4 pass analysis obtained using the 2313 Graphics Recorder with Application Package BZ 7001

Fig. 5. Typical plot of the 2032 (or 2034) Signal Analyzer display as copied using the 2313 as a conventional graphics printer with BZ 7000 or any other Application Package fitted

2313. As a result the entire measurement system may be operated via the interface and front panel pushkeys of the Recorder. For instance, using a simple pushkey command, measurements displayed on the Frequency Analyzer may be sent to the Recorder for documentation or storage, or if required may be relayed to another device such as a 7400 Digital Cassette Recorder. Similarly, tape recorded data may be documented or stored in one of the continuous or volatile memories of the 2313, provided that this originates from the Frequency Analyzer for which the Application Package is designed.

Provided along side the IEC interface, is an RS 232C Serial Interface. This provides a secondary means of remote control of the 2313 and other equipment covered by its Application Package, plus permits entry of personal text in the documentation presented by the Recorder (see Fig. 4). Alternatively, personal text may be entered via the front panel pushkeys of the 2313.

Specifications 2313

WRITING SYSTEM:
Dot-matrix printing on Metallized Paper QP 4690 using fixed 512-point print head with line width of 205 mm

Print Mode:
96 standard plus 32 special 6 by 8 matrix characters according to ISO 646 and 2022
Characters per Line: Selectable between 46 and 85
Character Height: Selectable 1,6; 3,2; 6,4 or 12,8 mm
Line Spacing: 0,4 to 2,8 mm
Print Rate: 3 full lines of 3,2 mm high characters per second corresponding to 250 characters per second

Graphics Mode:
Resolution: 25 dots/cm (63 dots/in)
Line Width: 204,4 mm
Line Spacing: 0,2 mm
Print Rate: 46 lines per second

PAPER DRIVE:
Step Length: 0,2 mm
Chart length: 297 mm A4 (metric) or 11 in (English) chart length
Page: Advances paper remainder of selected A4 or 11 in chart
Out of Paper: Warning printed plus paper drive automatically terminated at end of paper roll

IEC 625-1 STANDARD INTERFACE:
For system control plus digital input and output of data to be documented.

Connector: Standard 25-pin connector accepting Cable AO 0194 for connection to an IEC 625-1 interface system. Connection into an IEEE 488 interface system is made using Cable AO 0264, or Cable AO 0194 plus Adaptor AO 0195
Functions Implemented: Source Handshake (SH 1), Acceptor Handshake (AH 1), Talker (T 5), Listener (L 3), Service Request (SR 1), Remote Local (RL 1), Parallel Poll (PP 1), Device Clear (DC 1), Controller (C 1 to 5)
Transmission Speed: ~100 kbytes/s with direct memory access
System Control: Manual operation or use as system controller in accordance with Application Package
Job Specifications: Accepts job specification commands in IEC 625-2/IEEE Std. 728 format

RS-232C SERIAL INTERFACE:
For digital input of personal text

Connector: 25-pin (female) wired as DCE device
Transmission Speed: Selectable up to 9600 Baud

REMOTE CONTROL:
8-pin DIN socket providing make and break lines for control of external sound source, audible alarm, warning lamp etc. Maximum throughput 0,25 mA/200V

TEMPERATURE RANGE:
Operation: 5 to 40°C (41 to 104°F)
Storage: –25 to 70°C (–13 to 158°F)

HUMIDITY: up to 90% RH (non condensing) at 30°C

ELECTROMAGNETIC COMPATIBILITY:
Complies with Class B Device of the American FCC Rules

POWER REQUIREMENTS:
Complies with IEC 348 Safety Class II
Supply Voltage: 100; 115; 127; 200; 220; 240 V (50 to 60 Hz) ±10% AC
Power Consumption: 60 VA nominal (160 VA max. instantaneous)

CABINET:
Supplied as Model A (light-weight metal cabinet) or Model C (as A but with flanges for standard 19 in rack)

DIMENSIONS:
Metal cabinet, excluding knobs and feet
Height: 177 mm (7,0 in)
Width: 430 mm (16,9 in)
Depth: 500 mm (19,7 in)

WEIGHT: 17 kg (37,5 lb)

ACCESSORIES INCLUDED:

1 × Mains Cable	AN 0020
2 × 50 m Roll of Recording Paper	QP 4690
1 × 8-pin DIN Plug	JP 0802
1 × 25-pin IEC 625-1 Bus Connector Kit	UA 0793
1 × 25-pin RS-232C Male Connector	JP 2500
1 × Application Package	BZ 7000

ACCESSORIES AVAILABLE:

50 m Roll of Recording Paper	QP 4690
25-pin IEC 625-1 Interface Cable (2 m)	AO 0194
25-pin IEC (male, slide-lock) to IEC 625-1 Interface Cable (2 m)	AO 0184
25-pin Adaptor for coupling into IEEE 488 Interface System	AO 0195
25-pin IEC 625-1 to IEEE 488 Interface Cable (2 m)	AO 0264

APPLICATION PACKAGES AVAILABLE:

BZ 7001 for Digital Frequency Analyzer Type 2131 and Sound Intensity Analyzer System Type 3360. Lists and plots 1/1 and 1/3 octave spectra. Stores 302 spectra plus 1 auto. control sequence. Generates "Lin" and "A"-weight channel – adds, subtracts and averages spectra – multiple plots of up to 40 spectra – 1/12 octave analysis – reverberation and decay measurements – 3-parameter (amplitude/frequency/time) maps. Clock, trigger and wait functions also included.

BZ 7002 and 7003 for Digital Frequency Analyzers Type 2033 and 2031 respectively. List and plot time functions and narrow-band spectra. Store 62 spectra or 26×1k (2×10k) time functions, plus 1 auto. control sequence. Generate "Lin" and "A"-weight channel – 1/1 and 1/3 oct. spectra – distortion spectra – average spectrum and standard deviation. Also integration and differentation functions, as well as choice of auto-scaling and engineering units.

BZ 7004 for Sound Intensity Analyzer System Type 3360. Similar to BZ 7001 but with sound power measurements, sound contour and 3D plots (pressure and intensity), plus source localization (with Digital Cassette Recorder Type 7400) instead of 3-parameter mapping, average and multiple plots.

BZ 7005 for Measuring Amplifier Type 2636 plus Band Pass Filter Type 1617. Similar to BZ 7001 but with L_{eq} measurements, autoranging of 2636, remote control of 1617 and BT product instead of trigger function, 1/12 octave analysis, reverberation and decay measurements and multiple plots.

BZ 7006 for Dual Channel Signal Analyzers Types 2032 and 2034. Adds 1/1 and 1/3 Oct. synthesis plus envelope analysis functions to Analyzer. Provides automatic input and output to a connected Digital Cassette Recorder Type 7400. The 2313 plot functions are expanded to include display and plot of two sumperimposed curves, as well as several user-definable plot modications.

For more detailed information and specifications concerning the respective Application Packages, please ask for their separate Product Data Sheets.

---

*BZ 7000 permits use as a conventional alphanumeric printer plus direct copying of measurements displayed on Analyzers Type 2032 and 2034. For graphic plots with other B&K Analyzers, the Application Packages listed under Accessories Available should be employed.

2. CONTROLS

2.1. FRONT PANEL

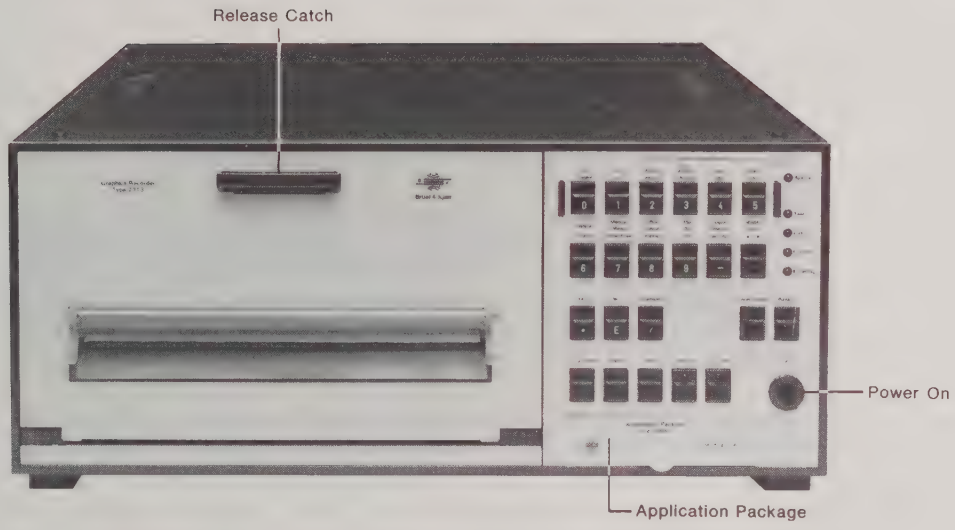


Fig. 2.1. Front panel of the Graphics Recorder Type 2313

Power On: On-Off switch for mains power. When set to **Power On**, either the **Active** or **Entering Lamp** at the top right hand corner of the front panel should light, accompanied by a print out of date and time.

Release Catch: Press down and pull to hinge forward the paper drive mechanism. See section 3.7 for details on paper loading and cleaning of the print head.

Application Package: Plug-in module determining the operating functions available with the Recorder, including with which measurement and analysis equipment the Recorder may be used. For documentation, storage and reformatting of measurement data transmitted by the B&K Sound Intensity Analysing System Type 3360 or the Digital Frequency Analyzer Type 2131, the Application Package BZ 7004 is employed. See section 3.6.

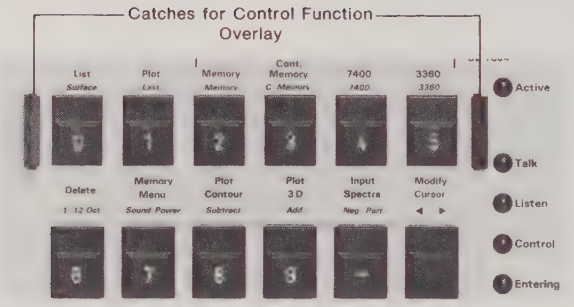


Fig. 2.2. Top two rows of pushkeys on the Graphics Recorder Type 2313 fitted with the Control Function Overlay SA 0304 belonging to Application Package BZ 7004

At the top right of the instrument are two rows of pushkeys (Fig. 2.2). These are for keying in numerical data with the **Set-Up** mode of the Recorder, and for specifying memory and tape files to and from which measurement data is to be relayed for documentation, storage etc.

The pushkeys also enable different functions and sub-functions to be selected. These depend on the particular Application Package employed and are printed on a Control Function Overlay which is included with each package. The Overlay is a small oblong sheet of plastic and is held in place by the catches on either side of the keys as indicated in Fig.2.2.

For operation with Application Package BZ 7004 the appropriate Control Function Overlay is SA 0304. Functions and sub-functions selectable using a single key stroke are indicated on the overlay and are headed by **plain** and ***italic*** text respectively. Generally, functions are used to specify a data destination (e.g. **Plot** spectra) and may be selected when the **Active Lamp** beside the pushkeys is alight (see also section 4.2), while sub-functions are used to specify a data source (e.g. ***3360***) and may be chosen following selection of a function when the **Entering Lamp** is alight.

Functions selectable using a single key stroke are:

List [0]
or
Plot [1]:
Generate hard-copy alphanumeric listing or fully annotated graphic plot of measurement displayed on the analyser, or one already processed or stored using the 2313 plus BZ 7004. See sections 4.2.1 and 4.2.2 respectively.

Move to Memory [2]
or
Move to C. Memory [3]:
Store measurement from the analyser (or one already processed or stored using the 2313) in the volatile Memory or the non-volatile Continuous Memory file of the Recorder. See sections 4.2.3 and 4.2.4 respectively.

Move to 7400 [4]:
Stores measurement from the analyser (or one already processed or stored using the 2313) in a tape file on the Digital Cassette Recorder Type 7400. See section 4.2.5.

Move to 3360 [5]:
Sets the 3360 for display of a measurement processed or stored using the 2313. See section 4.2.6.

Delete [6]:
Deletes measurement data stored in any one or group of non delete-secured memory files of the 2313, or all files of a non write-protected tape cassette on the 7400 or a surface for a sound power calculation. See section 4.2.7.

Memory Menu [7]: Produces short-form contents list of any one or group of memory files of the 2313, or of a tape file selected on the 7400. See section 4.2.8.

Plot Contour [8]: Produces contour plot plus multiple grey-tone plots of negative and positive intensity. See section 4.2.9.

Plot 3D [9]: Produces 3D plot from an array of measured spectra. Input may be 1/1, 1/3 or 1/12 octave spectrum files. See section 4.2.10.

Input Spectra [–]: For input of spectra to Memory from 7400 or from the 3360 using Remote Control Unit ZH 0250. Input may be 1/1, 1/3 or 1/12 octave spectrum files. See section 4.2.11.

Modify Cursor [ ]: Moves frequency cursor of the 3360, enabling the amplitude of one or more frequency bands of a stored spectrum displayed on the Analyzer to be altered using the **Modify Spectrum** function of the 2313. See section 4.2.13.

Sub-functions which may be selected using a single key stroke when the **Entering Lamp** is alight, are:

***Surface* [0]:** Enables a measurement surface around a test object to be defined, so that sound power may be determined from sound pressure or sound intensity measurements. See section 4.2.19.

Last* [1]:** Selects ***Last memory as the data source for repeating the previous operating function entered or a new function using previous data. ***Last*** may be used to list a measurement which was previously plotted for example or to transfer results to **Memory** or to **Cont. Memory**. The types of measurements which can be stored in ***Last*** are 1/1, 1/3 and 1/12 octave spectra, and map files. The information is placed in a special volatile memory file and is retained as long as the 2313 is powered, until a new function is used thus updating ***Last*** memory.

***Memory* [2]:** Selects the volatile memory as the data source for documenting, storing, deleting or modifying stored measurements depending on the particular destination or function selected.

***C. Memory* [3]:** Selects the continuous memory as the data source for documenting, storing, deleting or modifying stored measurements depending on the particular destination or function selected.

***7400* [4]:** Selects the 7400 Digital Cassette Recorder as the data source for documenting, storing or deleting tape recorded measurements provided that these have been previously processed by BZ 7004. See also **7400 File to BZ 7004 File** and section 4.2.20.

***3360* [5]:** Selects the 3360 (or the 2131) as the data source for documenting or storing a measurement.

***1/12 Oct* [6]:** Sub-function selecting 4-pass, 1/12 octave analysis of a signal measured with the analyser. See section 4.2.15.

***Sound Power* [7]:** Sub-function for determining sound power from sound intensity or sound pressure measurements. See section 4.2.16.

***Subtract* [8]:**
or
***Add* [9]:** Add or subtract any two 1/3, 1/1 or 1/12 octave measurements of the same type either arithmetically or logarithmically. The result is stored in the volatile memory of the 2313. See sections 4.2.17 and 4.2.18.

***Neg. Part* [–]:** Selects the negative part of intensity measurements for 3D plotting. See section 4.2.10.

Extended functions, (not indicated on the Overlay due to limited space) are selected by using two or more separate key strokes as indicated below.

1/12 oct. source location [/] [1]: Used to locate a noise source in a 1/12 octave band. See section 4.2.12.

Modify [/] [2]: Used to modify a spectrum partially or totally. See section 4.2.13.

Edit Surface [/] [3]: Used to modify an entered surface specification for the sound power function. See section 4.2.14.

7400 File to BZ 7004 File [24]: Selects the 7400 as the data source for conversion of manually recorded files on the 7400 for processing by the 2313 to produce BZ 7004 files which include 3360 settings, date and time. See section 4.2.20.

Multi. Subtract [/] [18]:
or
Multi Add [/] [19]: Subtracts a spectrum from or adds a spectrum to a series of spectra of the same type and stored consecutively in ***Memory***. See section 4.2.21.

Personal Text [/] [100]: Permits entry of up to five lines of personal text in the control heading of measurements documented with the 2313. Text is stored in the continuous memory of the Recorder and is entered in ASCII coded form using the front panel pushkeys or the RS-232C **Serial Interface** on the rear panel. See section 4.2.22.

Enter Sequence [/] [104]: Records a 100 step user-defined control sequence made up of different measurement, storage and documentation functions selectable with the front panel pushkeys. The sequence is stored in a specially allocated continuous memory file and is automatically deleted when **Enter Sequence** is selected for recording a new sequence. See section 4.2.26.

Execute Sequence [/] [103]: Activates 100 step control sequence recorded using the **Enter Sequence** function of the 2313. Permits a whole series of measurement, storage and documentation functions to be carried out fully automatically. See section 4.2.25.

Edit Sequence [/] [105]: Selects 100 step control sequence enabling it to be updated without first deleting the entire sequence. See section 4.2.27.

Shift Function [/] [106]: Updates control parameters recorded with the **Enter Sequence** function. Permits automatic stepping of centre frequency band, file no. etc. See section 4.2.28.

Wait [/] [107]: Delays activation of one or more functions of a recorded control sequence by preset multiple of the entered time. Is used in conjunction with **Enter Sequence** function. See section 4.2.29.

Wait Clock [/] [108]: Similar to **Wait** except that activation of a recorded control function is delayed until the built-in clock corresponds with the entered time (hour/minute/second). See section 4.2.30.

Relay On [/] [110]: Closes an external circuit via the **Remote Control** socket on the rear panel of the 2313. Used for automatically switching on externally connected equipment in connection with measurements. See section 4.2.31.

Relay Off [/] [111]: Opens an external circuit via the **Remote Control** socket on the rear panel of the 2313. Used for automatically switching off externally connected equipment in connection with measurements. See section 4.2.31.

Common functions (not indicated on the Overlay due to limited space) are activated via set-up and then work for several functions.

Print Lin and A [200]: Adds "Linear – 2 Hz to 22 kHz" and "A"-Weighted channels to a 1/1, 1/3 or 1/12 octave spectrum recorded with the 2313. See section 4.3.1.

Contour, 3D-expand [201]: Enables an area in contour plot or a 3D-plot to be expanded. See section 4.3.2.

Contour, 3D-plot [202]: Enables the parameters of contour- and 3D-plots to be changed i.e. interpolation steps, baseline levels, frequency interval and microphone spacings. See section 4.3.3.

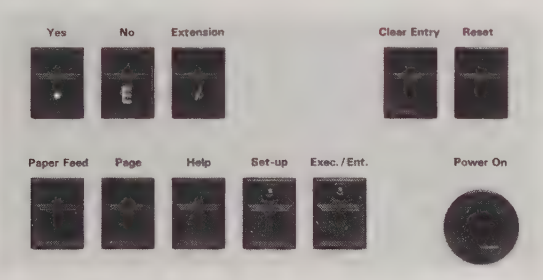


Fig. 2.3. Bottom two rows of pushkeys on the Graphics Recorder Type 2313

Other pushkeys. The remaining pushkeys of the Recorder (Fig.2.3) are not related to any particular Application Package.

Yes [.] and **No [E]:** For user communication and setting up of parameters with the Set-Up and Clock mode of the Recorder. The decimal point **[.]** and exponential **[E]** are secondary functions and are used when entering numerical data.

Extension [/]:

Extends the choice of functions available with the top two rows of pushkeys. Is also used to separate functions, parameters and numerical data etc., in order that they may be entered as a single string instead of individually. e.g.

Clear Entry:

Deletes last command or data entered using top two rows of pushkeys. Permits false entry to be corrected prior to activating **Exec./Ent.**

Reset:

Terminates selected function returning the Recorder to normal standby status. See section 3.8.1 for other types of reset available.

Paper Feed:

Advances paper as long as pushkey is held depressed. If **Exec./Ent.** is activated while **Paper Feed** is held depressed an automatic self-test is initiated. See section 3.8.2.

Page:

Advances paper the remainder of one full Metric or English page depending on the setting of the **Address Switch** on the rear panel.

Help:

Activates print-out of short-form data and instructions to aid entry of commands and other data via the front panel pushkeys.

Set-Up:

On-Off key, which initiates the setting up procedure for the different forms of read-out. The built-in lamp of the key lights when the Set-Up procedure is activated. See section 3.9.

Exec./Ent:

Executes a command or terminates entry of data via the front panel pushkeys. The built-in lamp of the key lights when **Exec./Ent.** is activated and command execution is in progress. Pressing **Exec./Ent.** immediately after a function has been executed will repeat the function and where pertinent will automatically update memory and tape file parameters etc. See section 4.2.

Active Lamp:

Lights when the Recorder is used as a system controller (e.g. **Address Switch** set to "System Controller Active"), and data is not being entered. Indicates that the Recorder is ready to accept a function via the front panel pushkeys of the instrument.

Talk Lamp:

Lights when the Recorder is sending data over the IEC Interface.

Listen Lamp:

Lights when the Recorder is receiving data over the IEC Interface.

Control Lamp:

Lights when the Recorder is sending IEC control commands over the IEC Interface.

Entering Lamp:

Lights when the Recorder is ready to accept numerical data entered via the front panel pushkeys of the instrument or sent over the IEC Interface.

2.2. REAR PANEL

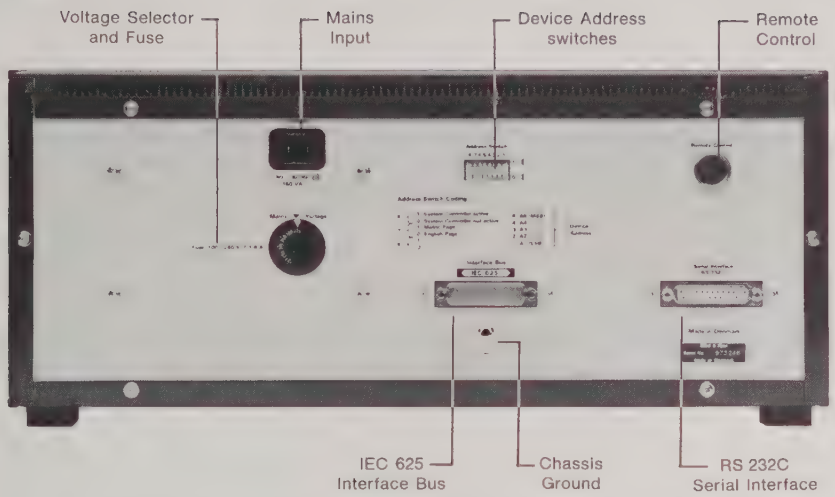


Fig. 2.4. Rear panel of the Graphics Recorder Type 2313

Address Switch:

A set of eight miniature two-position rocker switches for manual selection of device address number with the digital interface bus of the 2313, plus selection of "System controller Active" or "Not Active" and "Metric" or "English" page length. On delivery the **Address Switch** numbers A5 to A1 are set to "00001" (i.e. device address number 1). See sections 4.1.

IEC 625 Interface Bus:

25-pin connector conforming to IEC 625-1. Is for digital input and output of measurement data plus remote control of the measurement and recording system via a IEC 625-1 or IEEE std. 488 digital interface bus. See introduction of Chapter 6 for appropriate interface cable.

RS 232C Serial Interface:

25-pin connector for digital input of personal text plus remote setting of the front panel pushkeys and operating set-ups of the Recorder via the keyboard of an RS 232C terminal. See Chapter 7.

Remote Control:

8-pin socket accepting the standard DIN plug (B&K no. JP 0802) with screw-lock provided. Permits remote switching of external equipment. Maximum current 0,25 A, maximum voltage 200 V and maximum power 3 W. See Fig.2.5 and the functions Relay on and Relay Off Section 4.2.31.

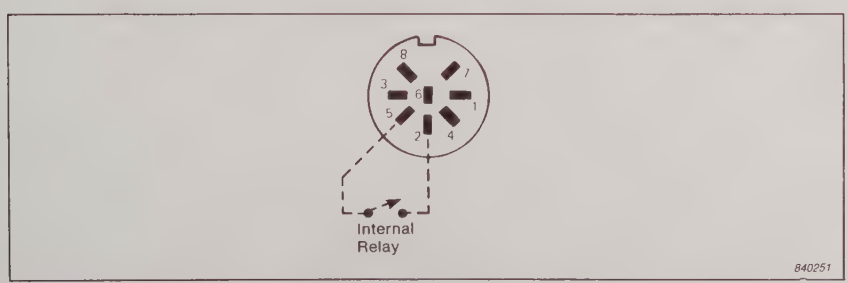


Fig. 2.5. Remote Control Socket on the rear panel of the Graphics Recorder Type 2313

Voltage Selector and Fuse:

Voltage selector for operation from a 100; 115; 127; 200; 220 or 240 V AC mains supply. The selector also contains a slow blow mains fuse. To select the appropriate voltage setting and fit the correct fuse, see section 3.3.

Mains Input:

2-pin socket accepting the Power Cable AN 0020 provided for connection of an AC mains supply. Before connecting a supply, the mains voltage setting and fuse checks given in section 3.3 should be carried out to ensure safe operation of the instrument.

3. PRELIMINARY

3.1. ENVIRONMENT AND HANDLING

The Graphics Recorder Type 2313 is designed for indoor use at temperatures from +5° to +40°C (+41° to +104°F) and humidities up to 90% RH (non-condensing) at 30°C. Before each use of the instrument check that it is set to match the available supply voltage as described in section 3.3.

To ensure reliable operation of the 2313, it is important that the following be observed:

- When first using the 2313 keep it powered for approximately 14 hours to prevent loss of data stored in its continuous memory.
- If the 2313 is not to be used for 4 weeks or more, disconnect the internal Ni-Cd battery used to power its continuous memory (see section 3.4).
- For optimal reproduction of printed data regularly clean the print head of the 2313 as described in section 3.7. Avoid use of chemical cleaning agents and sharp tools, as these can damage the print head.

3.2. BENCH AND RACK MOUNTING

The 2313 may be used free-standing on its four plastic feet or, with the addition of the Flanges KS 0024 available, may be mounted in a 19 inch instrumentation rack. The flanges fasten via two screw holes at the front of the instrument side panels. These are accessible on easing back the bottom panel fastened by two screws on the rear of the instrument, and withdrawing the plastic corner plus grooved plastic strips at the front of the side panels. Before releasing the bottom panel ensure that 2313 is disconnected from the mains supply.

3.3. CONNECTION OF MAINS SUPPLY

Before connecting a mains supply, the following mains voltage setting and fuse checks should be carried out to ensure safe operation of the instrument.

Mains Voltage Setting

The 2313 may be powered from 100, 115, 127, 200, 220 and 240 V ±10% (50 to 60 Hz) single phase AC mains lines. To select the correct mains voltage setting, use a small screwdriver to push in and release the fuse holder at the centre of the **Mains Voltage Selector** on the rear panel. Pull the fuse holder straight out and using a small coin or wide-blade screwdriver turn the selector disc so that the appropriate voltage setting lines up with the black arrow printed on the panel.

Fuse Rating

To check or replace the mains fuse, release and withdraw the fuse holder at the centre of the **Voltage Selector**. For operation from 100 to 240 V AC supplies the fuse should be a 1,6 A slow blow (B & K no. VF 0007). Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of mended fuses and the short circuiting of fuse holders should be avoided.

Supply Connections

Once the mains voltage setting and fuse have been checked, the mains supply may be connected to the **Mains Input** socket of the 2313 using the Power Cable AN 0020 supplied. The 2313 has a high standard of safety insulation in accordance with safety class II of IEC 348 and therefore its chassis need not be connected to mains ground.

3.4. CONNECTION OF CONTINUOUS MEMORY SUPPLY

Both the continuous memory and built-in clock of the 2313 are powered by a rechargeable Ni-Cd battery. As standard this is supplied already wired in the 2313, but to avoid unnecessary power drain during storage and shipment is internally disconnected from the instrument.

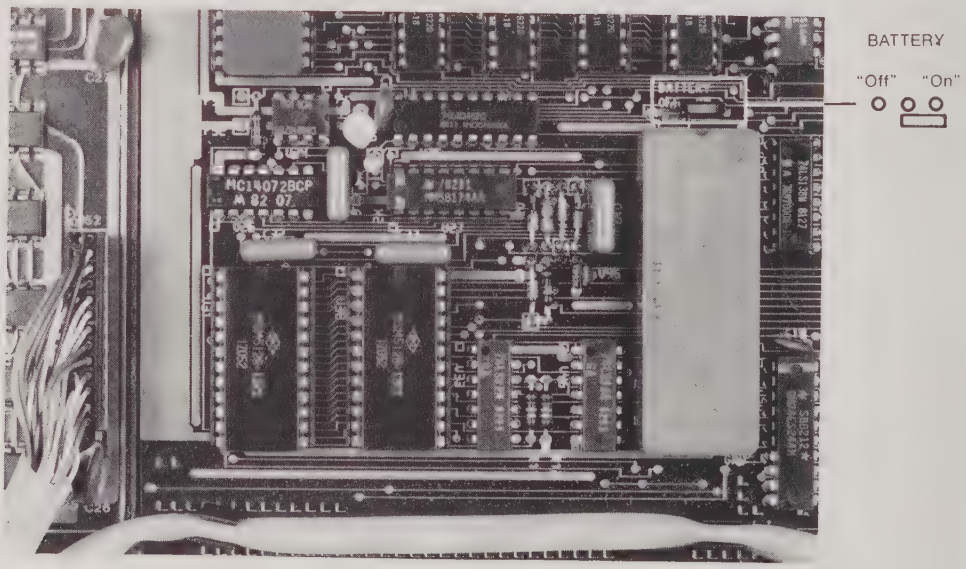


Fig. 3.1. Contact clip for connecting and disconnecting the internal Ni-Cd battery used for powering the continuous memory and clock of the 2313

To connect the Ni-Cd battery, disconnect the mains supply from the 2313 and remove its top panel which is fastened by two screws on the rear of the cabinet. The battery is located on the main circuit board on the base of the instrument. It may be connected by sliding off the contact clip from the group of three pins shown in Fig. 3.1 and using it to connect the centre pin and pin marked "On".

For recharging the Ni-Cd battery, the 2313 has its own charging circuit built-in. This is operative as long as the 2313 is powered from a mains supply and keeps the continuous memory powered more or less indefinitely provided that the 2313 is subjected to approximately 30 minutes use each day, 3,5 hours use each week or 14 hours use every 4 weeks. However, when using the 2313 for the first time it should be kept powered for at least 14 hours to ensure that the battery attains full charge capacity.

WARNING! To prevent damage to the battery ensure that it is regularly charged. If the 2313 is not to be used for more than 4 weeks, recharge the battery for approximately 14 hours and disconnect it as described above.

3.5. GROUNDING CONSIDERATIONS

Indiscriminate grounding of instruments can introduce ground loop interference. To prevent this influencing the measuring and analyzing instruments with which the 2313 is used it is important that the signal and digital ground lines of the instruments are grounded at one point only in the measurement system. To do this without prejudicing the operating safety of the instruments, proceed as follows:

1. Connect the signal ground lines of all instruments together. This is done automatically through the screens of the input and output cables used to interconnect the instruments.

2. Where the same instruments are interconnected by more than one signal cable or combination of signal and remote control cables each containing a signal ground connection, keep the cables short and close together or disconnect the signal ground line of all but one of them.

3. Where instruments are interconnected by a digital interface cable containing a chassis ground connection, check that one and only one of these instruments has its signal ground or digital ground connected to chassis (and chassis connected to mains ground if equipped with a mains connector having a protective earth - chassis contact).

4. Where the measurement arrangement is used free-standing without the instrument cabinets touching, check that each of the other instruments in the measurement arrangement has its chassis connected to a) mains ground only or b) signal ground or digital ground only. With instruments equipped with a mains connector having a protective earth-chassis contact, a) is to be preferred.

5. Where the measurement arrangement is mounted in an instrumentation rack, ensure that one and only one of the instruments has its signal ground or digital ground connected to chassis (and chassis connected to mains ground if equipped with a mains connector having a protective earth - chassis contact). If more than one of the instruments has a permanent signal ground - chassis connection, then isolate the cabinets of these instruments from the rack.

6. Finally, where the signal ground line is connected to mains ground via the mains connector of one of the instruments, isolate the housing of the measurement transducer from grounded measurement sources.

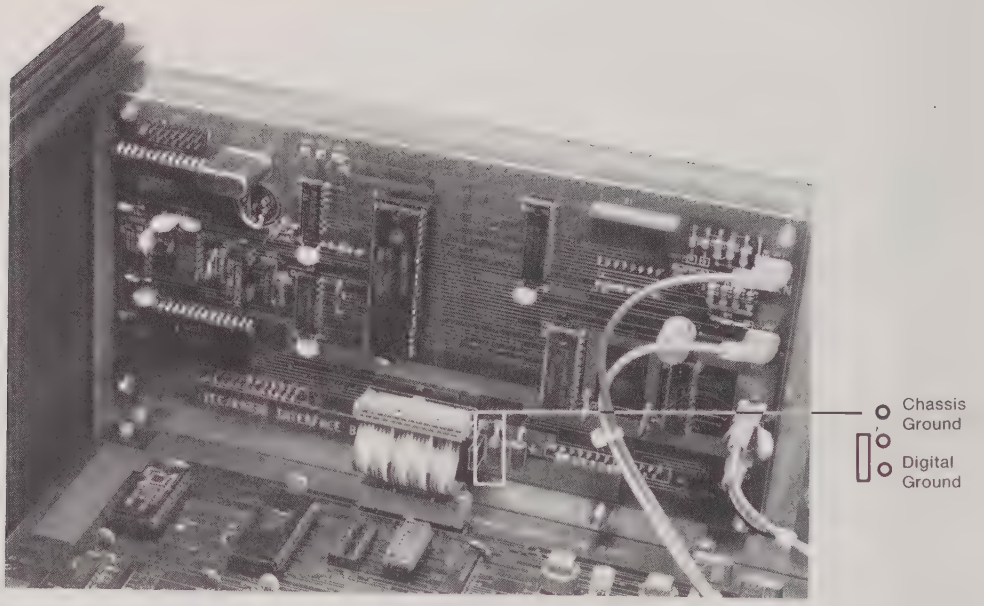


Fig. 3.2. The digital and chassis ground contacts of the 2313

As standard the 2313 is delivered with its digital ground connected to chassis, which is that normally required for operation in most instrument set-ups. However, where the above grounding requirements dictate otherwise, they may be disconnected from one another by carefully easing off the contact clip from the interface board contacts shown in Fig. 3.2 and using it to connect the top and middle contacts indicated. The interface board is mounted on the rear panel and is accessible on sliding off the top panel which is fastened by two screws at the back of the instrument. Before removing the top panel ensure that 2313 is disconnected from the mains supply.

WARNING! The 2313 is designed to be operated with its digital ground and chassis at zero earth potential. Never let the signal ground terminals, socket screens or chassis float at other than approximately zero earth potential, as this will impair the operating safety of the apparatus and may damage it.

3.6. INSTALLATION OF APPLICATION PACKAGE

Application Package BZ 7004 especially converts the 2313 for documenting, storage and reformatting measurement data transmitted by the B&K Sound Intensity Analysing System Type 3360 and Digital Frequency Analyzer Type 2131. It also facilitates use of a Digital Cassette Recorder Type 7400, thus enabling tape recorded measurements to be handled, provided that these originate from either the 3360 or 2131. For operation with other digital equipment, one of the other Application Packages available for the 2313 should be employed. See Chapter 1.

Before replacing an Application Package with BZ 7004, it is advisable to check the contents of the continuous and volatile memories of the 2313 using the **Memory Menu** function. If important data from previous measurements is present, then it should be recorded on tape as described in section 4.2.5. This is necessary as stored data will be automatically deleted when BZ 7004 or another Package is fitted.

Having carried out the above check, the Application Package may be replaced by BZ 7004. To do this set the **Power On** switch of the 2313 to "Off", unscrew the captive fastening on the front of the Package and use this to pull the Package out of the

Recorder. BZ 7004 may then be inserted and its Control Function Overlay SA 0304 clipped over the top row of pushkeys on the front panel as indicated in Fig. 3.3. For protection from dust and other foreign matter never leave the Recorder without a Package fitted and store Packages not in use in their mahogany case together with their Control Function Overlay.

Fig. 3.3. Installation of Application Package and Control Function Overlay

3.7. PAPER LOADING AND CLEANING OF PRINT HEAD, RUBBER ROLLER & SPINDLES

To load the 2313 with a fresh roll of Paper QP 4690, proceed as follows:

1. Press down the **Release Catch** on the front panel and pull forward the paper drive frame as shown in Fig. 3.4.

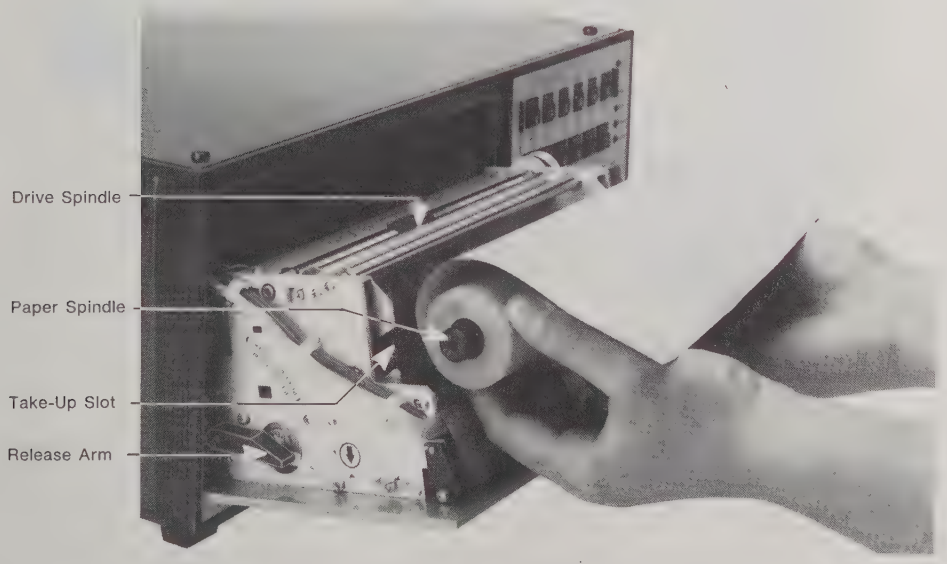


Fig. 3.4. The Paper Drive Frame of the 2313

2. Lower the **Release Arm** on the left of the drive frame and lift out the paper spindle together with the remainder of the old paper roll if one is fitted.

3. Wipe a soft lint-free cloth along the rear of the print head to remove traces of print dust which may have accummulated during previous use. See Fig. 3.5.

4. Slide a fresh roll of Paper QP 4690 onto the paper spindle and hold it just in front of the drive frame as shown in Fig. 3.4.

5. Push each end of the paper spindle into the empty **Take-Up Slots** on either side of the drive frame and check that the spindle clips fast on the ball-catches in the slots.

6. Remove the adhesive label and pull out approximately 30 cm (12 in) of paper from the roll.

7. Carefully feed the free end of the paper between the guide and drive spindles until it protrudes from the opening on the front panel of the drive frame.

8. Lightly pull the free end of the paper to take up any slackness and raise the **Release Arm** on the left of the drive frame to lock the pressure spindle.

9. Hinge up the front of the drive frame so that it is flush with the front panel of the 2313 and push the **Release Catch** up to lock.

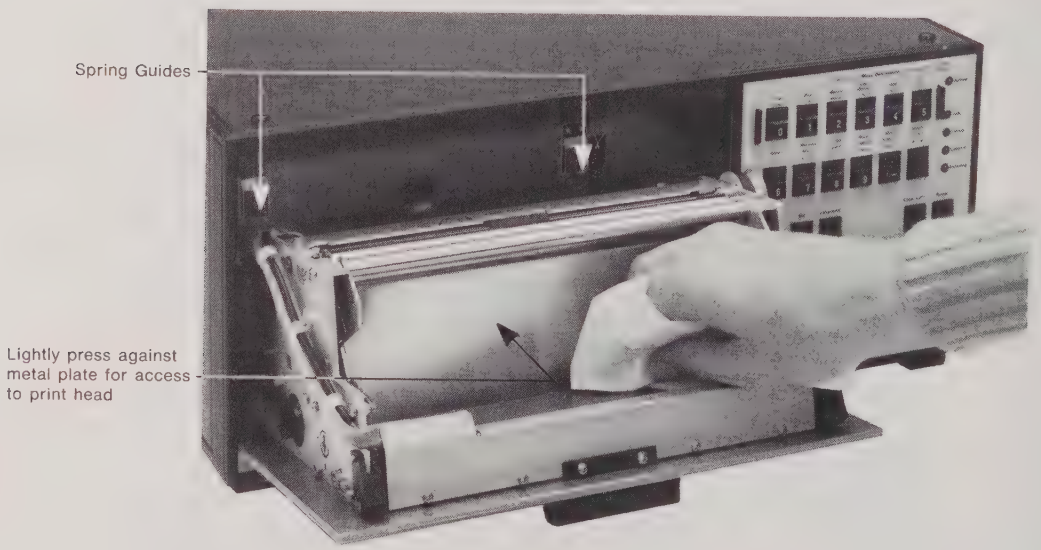


Fig. 3.5. Cleaning the Print Head of the 2313

After loading a fresh roll of recording paper it is recommended that the Self-Test mode of the 2313 be activated as outlined in section 3.8.2. Provided that Recorder is functioning correctly then it should generate an exact replica of the test print shown in Fig.3.6.

Should the test print show signs of uneven printing or lack contrast, then it is likely that there are more firmly embedded traces of print dust on the print head. These may be removed by lightly brushing with a soft bristled tooth brush and wiping with a lint-free cloth as shown in Fig. 3.5. For access to the print head carry out items 1 and 2 above

and gently press the metal plate at the rear of the writing system to move it 1 or 2 mm away from the head.

The two spindles which are in contact with the metalised side of the paper act as common current contacts. If the spindles become covered with a grey deposit a poor contact may ensue. Remove the deposit using a cloth and ordinary metal polish.

If the paper slips during printout it may be caused by too low a friction between the rubber roller and the paper. Paper dust may be removed from the rubber roller by means of cloth moistened with alcohol.

If the paper starts to run slightly out of alignment, causing it to curl or fold at either its left or right-hand edges, then it is possible that the spring guides at the rear of the writing system compartment require attention (see Fig. 3.5). Normally this is not a frequent occurence and can easily be rectified by gripping the bottom of the guide nearest the faulty edge of the paper and bending it out slightly so that it makes proper contact with the paper when the writing system is folded back into the Recorder.

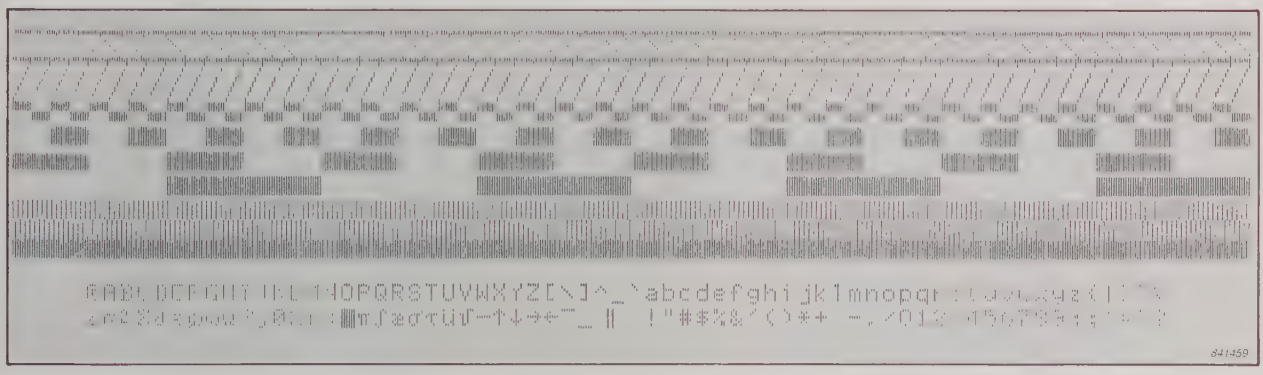


Fig. 3.6. Test print obtained using the self-test mode of the 2313

3.8. USE OF RESET AND AUTOMATIC SELF–TEST

3.8.1. Reset

Three types of **Reset** are available for returning the 2313 to normal standby status following choice of an incorrect function or one that is not self terminating. Selection of a new function is then possible. The various resets are:

1. Reset
2. Power on reset
3. Hard reset

Reset

Pressing **[Reset]** also ensures that the 2313 always selects the appropriate control mode following alteration of its **Address Switch**. In addition, a reset is capable of restoring normal operation of the Recorder when this has been blocked by a minor malfunction or mains interference. However, whether this use of the **Reset** key is successful or not largely depends on type of disturbance.

Power On Reset

If **Reset** is not successful, normal operation can usually be restored by selecting **[Power Off]** for a couple of seconds and then selecting **[Power On]**. This performs a *power on reset*, which returns the 2313 to its initial power on status, and deletes measurement

data stored in its volatile memory. If desired a *power on reset* can be performed as part of Self-Test, which is described in section 3.8.2.

Hard Reset

Another way of restoring normal operation after a minor malfunction is by pressing the **[Paper Feed]** pushkey and whilst keeping it pressed, momentarily pressing **[Reset]**. This performs a *hard reset* which resets the entire instrument including its built-in clock, and deletes all measurement data in its volatile and continuous memories. A *hard reset* should therefore only be performed after having tried the other methods of reset described.

If the 2313 fails to respond correctly even after a *hard reset*, then it is likely that a more serious fault has occurred. To check the Recorder plus the Application Package the Self-Test mode discussed in section 3.8.2 can be employed.

It is important to note that according to IEC Standards all instruments connected together via the IEC interface bus must be switched on. Instruments which are not switched on but are connected to the bus may disrupt the control signals on the bus and cause the system to jam.

3.8.2. Self-Test

The 2313 is equipped with a Self-Test mode for checking the functioning of the instrument. The two Self-Tests available may be designated as Test-Cycle Self-Test and Test-Chart & Test Cycle Self-Test.

Test-Cycle Self-Test

This Self-Test is activated by pressing **[Modify Cursor]** and while keeping this key depressed, by momentarily pressing **[Reset]**. The following test cycle then begins. The Self-Test mode lights all five control lamps in the top right corner of the front panel and proceeds to check the electronic circuitry of the Recorder and Application Package. Upon the satisfactory completion of each check, the relevant control lamp is automatically extinguished and the next check commenced until finally only the **Active Lamp** remains alight and the date and time are printed out, indicating that the test cycle is completed. A *power on reset* is performed which returns the 2313 to normal operating status and deletes measurement data stored in the volatile memory.

Test-Chart & Test Cycle Self-Test

This Self-Test does not delete existing data. It provides a print out of a test chart at the start of the test cycle which is useful for checking the writing system of the Recorder (see section 3.7). This Self-Test is activated by pressing the **Paper Feed** pushkey and while keeping it depressed, by pressing **Exec./Ent.** Note that the "System Controller Active" mode must first be selected by setting **Address Switch** number 8 on the rear panel to "1" (see Fig. 4.3.) and pressing the **Reset** pushkey.

After printing the test chart, the Self-Test mode lights all five control lamps in the top right corner of the front panel and proceeds to check the electronic circuitry of the Recorder and Application Package. Upon the satisfactory completion of each check, the relevant control lamp is automatically extinguished and the next check commenced until finally only the **Active Lamp** remains alight, indicating that the test sequence is completed and that the Recorder has returned to normal operating status.

Provided that the 2313 is functioning correctly, the entire test sequence lasts approximately 75 seconds. If, however, a fault is detected then the test sequence will halt. At

the same time the relevant control lamp for the test plus those yet to be completed will flash, warning that a fault is present.

Where Self-Test is automatically interrupted and only the **Entering** and **Control** lamps remain extinguished, then it is likely that only the Application Package is at fault. To check whether this is the case, disconnect mains power and reactivate Self-Test with another Package fitted. For repair of the Recorder and/or Application Package, please contact your local B&K service representative. Under no circumstances should repair be attempted by persons not qualified in the service of electronic equipment.

3.9. SET–UP PROCEDURE

After the installation of an Application Package BZ 7004 and of a roll of Recording Paper QP 4690, one may proceed directly with operation as described in Chapter 4. However, to make full use of the documentation, storage and measurement functions available with BZ 7004, and to ensure correct read out of date, time etc., it is necessary to understand how the Set-up mode of the Recorder is designed.

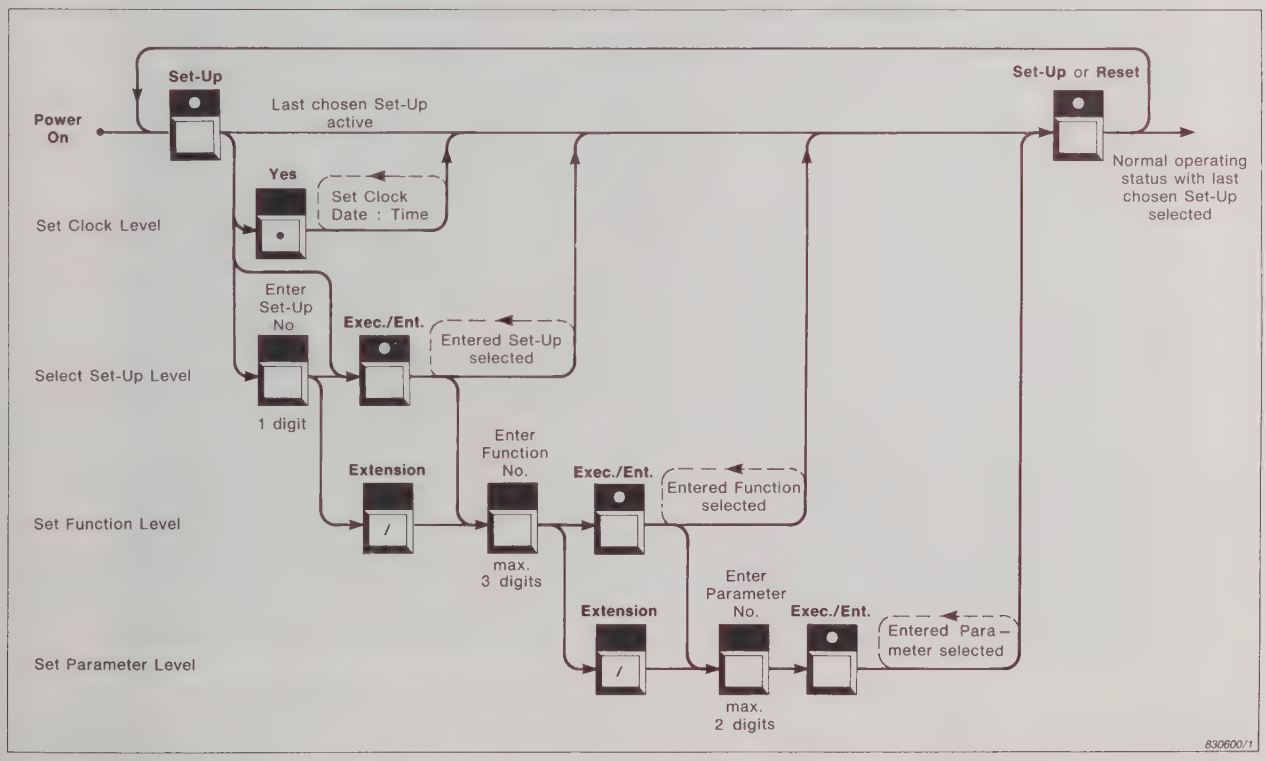


*Fig. 3.7. Simplified flow-diagram for selection of set clock level, as well as individual Operating Set-Ups, functions and parameters with the **Set–Up** mode of the 2313*

The 2313 possesses 4 **Set-Up** modes numbered from 0 to 3 any one of which may be chosen with the "Select Set-Up" key in the bottom row of pushkeys of the Recorder. As indicated in Fig.3.7 it provides access to the "Select Set-Up", "Set Function", "Set Parameter" and "Set Clock" levels of the Recorder, the use of which are briefly discussed here and in more detail in the following sections. Each Set-Up is furnished with the functions and parameters listed in Fig. 3.8 which are individually numbered to permit access via the front panel pushkeys of the Recorder. It is very helpful to have a complete function list and a parameter list at one's side when getting to know the instrument.

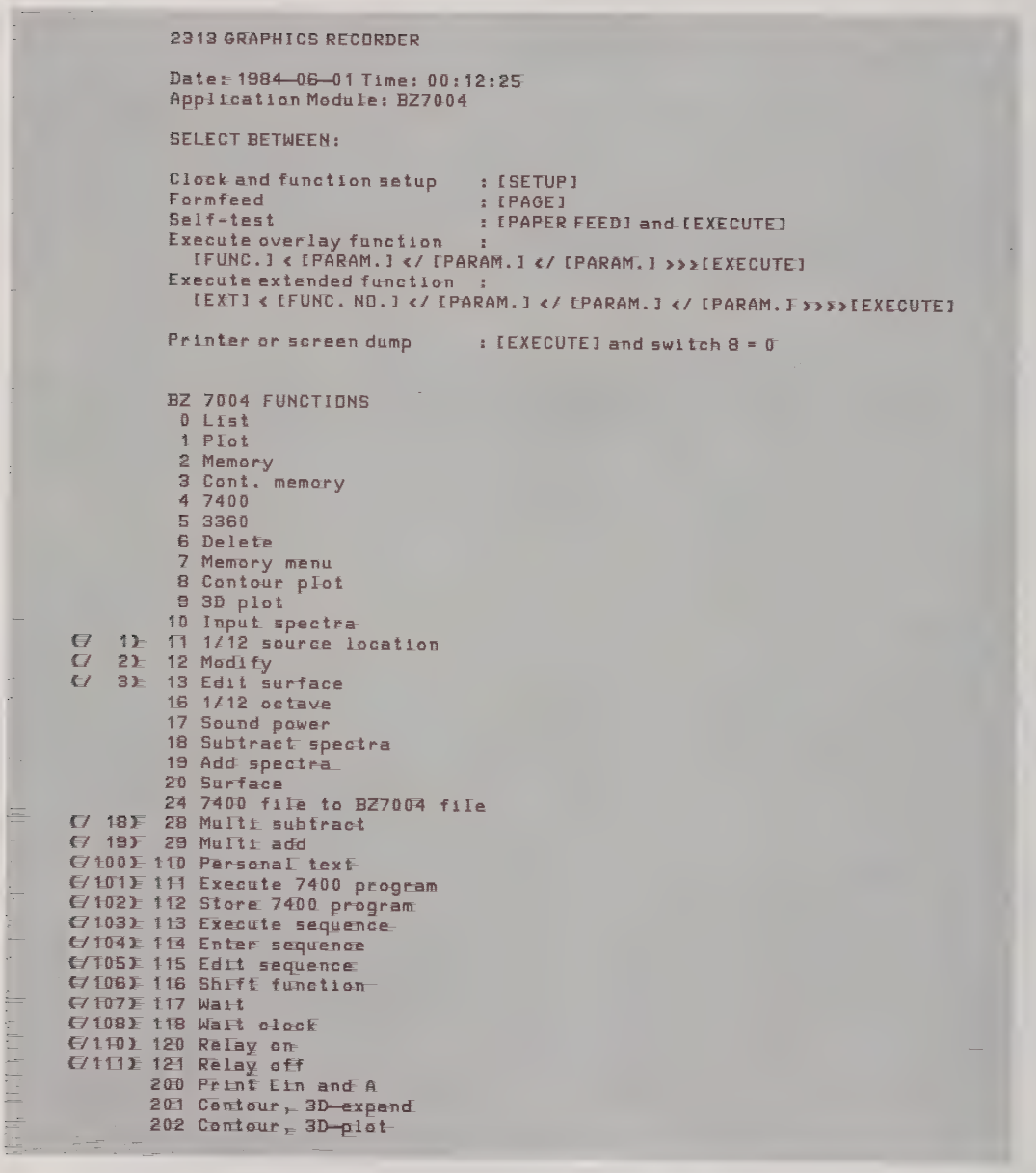


Fig. 3.8. Function list obtained by pressing **[Clear Entry] [Help]**

OP2313CB0

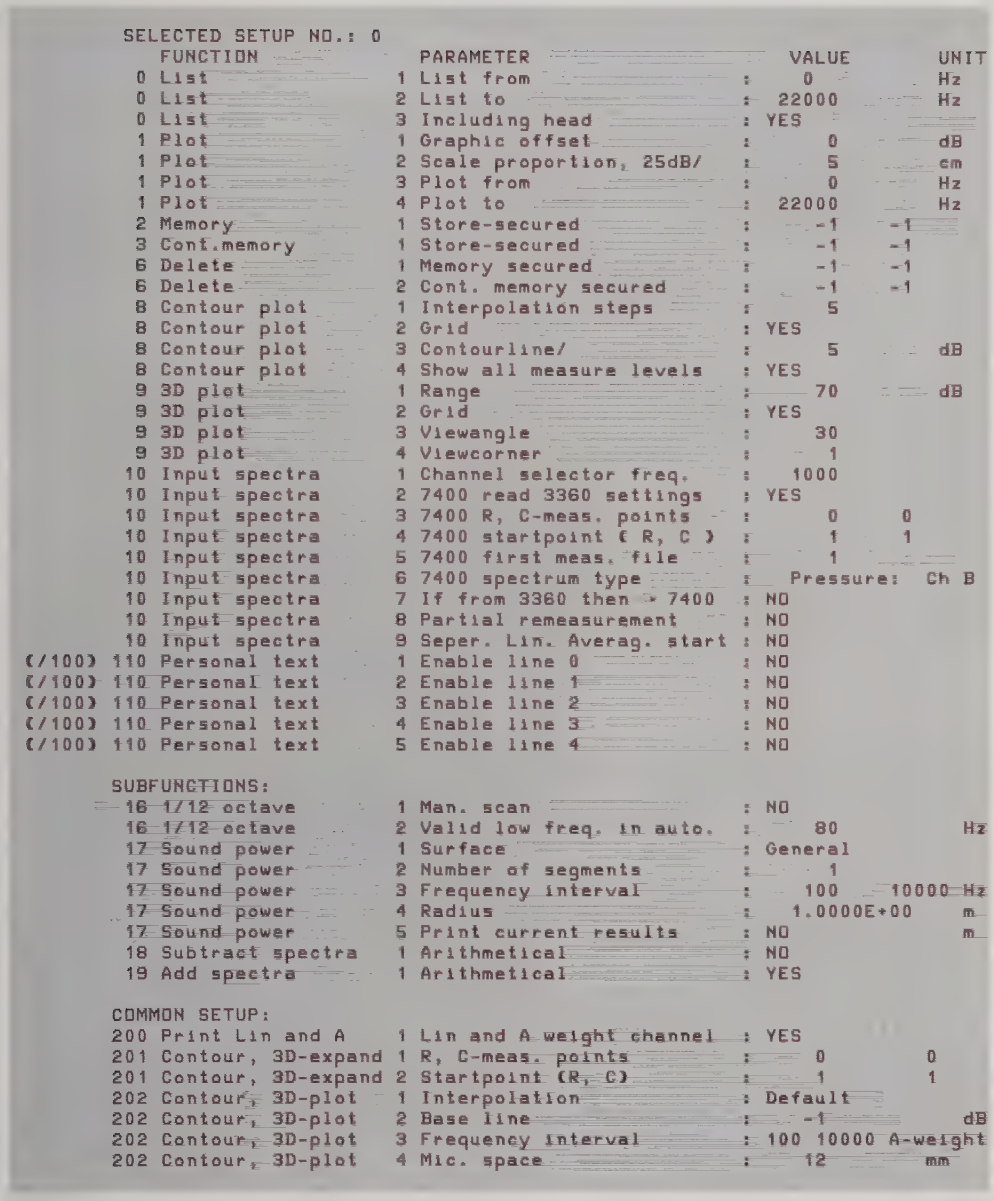
Function list

For a complete list of the functions available in BZ 7004 press **[Clear Entry] [Help]**.

Parameter list

For a complete list of the available set-up parameters for all functions press **[Set-Up] [Exec./Ent.] [.]**. Come out of the set-up mode again by pressing **[Set-up]**.

The parameter values and units of Set-Up No: 0 are fixed, but those of Set-Ups 1 to 3 may be changed by the user. The range of values and units to which the different parameters may be set depends on the particular control function to which they belong and are as specified in sections 4.2.1 to 4.2.32 and 4.3.1 to 4.3.3 respectively.



```
SELECTED SETUP NO.: 0
     FUNCTION                PARAMETER                    VALUE        UNIT
  0  List                 1  List from                :      0          Hz
  0  List                 2  List to                  :  22000          Hz
  0  List                 3  Including head          : YES
  1  Plot                 1  Graphic offset          :      0          dB
  1  Plot                 2  Scale proportion, 25dB/ :      5          cm
  1  Plot                 3  Plot from               :      0          Hz
  1  Plot                 4  Plot to                 :  22000          Hz
  2  Memory               1  Store-secured           :     -1     -1
  3  Cont.memory          1  Store-secured           :     -1     -1
  6  Delete               1  Memory secured          :     -1     -1
  6  Delete               2  Cont. memory secured    :     -1     -1
  8  Contour plot         1  Interpolation steps     :      5
  8  Contour plot         2  Grid                    : YES
  8  Contour plot         3  Contourline/            :      5          dB
  8  Contour plot         4  Show all measure levels : YES
  9  3D plot              1  Range                   :     70          dB
  9  3D plot              2  Grid                    : YES
  9  3D plot              3  Viewangle              :     30
  9  3D plot              4  Viewcorner             :      1
 10  Input spectra        1  Channel selector freq.  :   1000
 10  Input spectra        2  7400 read 3360 settings : YES
 10  Input spectra        3  7400 R, C-meas. points  :      0      0
 10  Input spectra        4  7400 startpoint ( R, C ) :      1      1
 10  Input spectra        5  7400 first meas. file   :      1
 10  Input spectra        6  7400 spectrum type      :  Pressure:  Ch B
 10  Input spectra        7  If from 3360 then > 7400 : NO
 10  Input spectra        8  Partial remeasurement   : NO
 10  Input spectra        9  Seper. Lin. Averag. start : NO
(/100) 110 Personal text  1  Enable line 0           : NO
(/100) 110 Personal text  2  Enable line 1           : NO
(/100) 110 Personal text  3  Enable line 2           : NO
(/100) 110 Personal text  4  Enable line 3           : NO
(/100) 110 Personal text  5  Enable line 4           : NO

SUBFUNCTIONS:
 16  1/12 octave          1  Man. scan               : NO
 16  1/12 octave          2  Valid low freq. in auto. :     80          Hz
 17  Sound power          1  Surface                 : General
 17  Sound power          2  Number of segments      :      1
 17  Sound power          3  Frequency interval      :    100    10000 Hz
 17  Sound power          4  Radius                  :  1.0000E+00      m
 17  Sound power          5  Print current results   : NO               m
 18  Subtract spectra     1  Arithmetical            : NO
 19  Add spectra          1  Arithmetical            : YES

COMMON SETUP:
200  Print Lin and A      1  Lin and A weight channel : YES
201  Contour, 3D-expand   1  R, C-meas. points       :      0          0
201  Contour, 3D-expand   2  Startpoint (R, C)       :      1          1
202  Contour, 3D-plot     1  Interpolation           : Default
202  Contour, 3D-plot     2  Base line               :     -1          dB
202  Contour, 3D-plot     3  Frequency interval      : 100 10000 A-weight
202  Contour, 3D-plot     4  Mic. space              :     12          mm
```

OP2313CA0

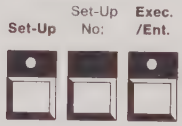
Fig. 3.9. Functions and parameters available with of Application Package BZ 7004 obtained by pressing **[Set-Up] [Exec./Ent.] [.]**. *Leave set-up mode again by pressing* **[Set-Up]**. *The values shown are the default values*

The individual Set-Ups are stored in the continuous memory of the Recorder and therefore are not affected by disconnecting mains power to the apparatus. If, however, another Application Package is inserted or the charge state of the internal Ni-Cd battery is allowed to fall below that required to power the continuous memory, then Set-Ups No: 1 to 3 will be automatically reset to the corresponding values of the Default Set-Up (i.e. Operating Set-Up No: 0). Also Operating Set-Up No: 1 will be automatically selected when first powering the instrument, instead of the set-up last chosen during previous use.

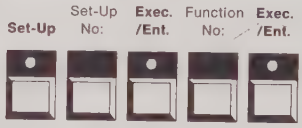
The basic pushkey sequences for selecting the various Set-up mode levels, are as follows:

Select Clock:

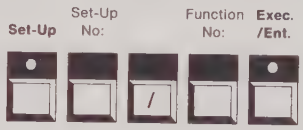
Select Set-up:



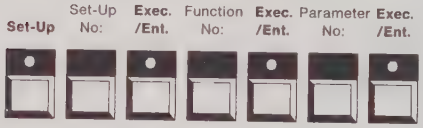
Select Function:



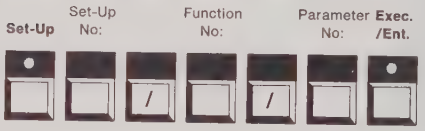
or:



Select Parameter:



or:



further details of which are given in the following sections. If at any stage there is doubt about which Set-Up, Function or Parameter has been entered, or as to which values and units may be entered, press the **Help** key.

3.9.1. Setting the Clock

For a correct record of date and time at the top of each readout, the built-in clock of the 2313 must be properly set as described below, employing the pushkey sequence shown in Fig. 3.10.

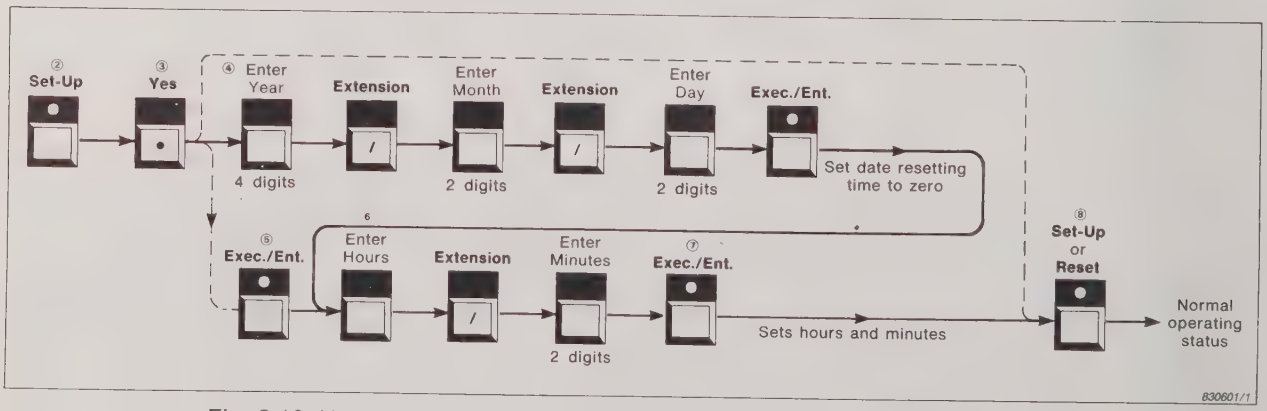


*Fig. 3.10. Use of the **Set-Up** mode for setting date and time with the 2313*

1. Select **Power On**. Either the **Active** or **Entering Lamp** will light, and the date and time set with the internal clock printed.

```
DATE: 1984-02-01      TIME: 8:30:16
```

If `CONTINUOUS MEMORY AND CLOCK CLEARED` and/or `DATE: 9999 -01-01` is printed, check that the internal Ni-Cd battery for the continuous memory is connected before proceeding with step 2. See section 3.4.

2. Press **Set-Up** to activate the set-up mode and to print the identity of the set-up selected. At the same time the **Set-Up** and **Entering Lamps** will light and, if already alight, the **Active Lamp** extinguished.

```
Setup mode, active setup no: 1
```

3. Press **Yes** to activate the set clock mode, as well as print the date and time currently set.

```
Date: 1984-02-01      Time: 8:33:12     Enter Date
```

If both the date and time are correct, go to step 8 to return the 2313 to its initial operating status.

If only the date is correct, press **Exec./Ent.** and go to step 6 to enter the correct time.

4. For entry of the correct date, key-in **[YEAR] [/] [MONTH] [/] [DAY]** in turn. e.g.

To correct a false entry, press **Clear Entry** to delete, and re-enter the **[YEAR] [/] [MONTH] [/] [DAY]**.

5. Press **Exec./Ent.** to set the clock to the entered date and reset tne time to zero.

```
Date: 1984-02-12      Time: 00:00:00    Enter time
```

6. To enter the correct time, key-in **[HOURS] [/]** and **[MINUTES]** one minute ahead of actual time. e.g.

To correct a false entry, press **Clear Entry** to delete, and re-enter **[HOURS] [/] [MINUTES]**.

7. Wait until the actual time corresponds to the value entered and press **Exec./Ent.** to set the clock to the correct time.

```
Date: 1983-06-12      Time: 10:45:00    Enter date
```

If the time set is not quite correct, press **Exec./Ent.** one more time and return to step 6.

8. Once the date and time are accurately set, press **Set-Up** to return the 2313 to normal standby status. The **Set-Up Lamp** should be extinguished and either the **Active** or **Entering Lamps** light again.

3.9.2. Selecting a Set–Up

The "Select Set-Up Level" of the **Set–Up** mode permits selection of a suitable Operating Set-Up for documenting and reformatting measurements. In addition it may be used for listing and setting one or more complete set-ups to default. The pushkey sequence employed is as described below and is illustrated in Fig.3.11.

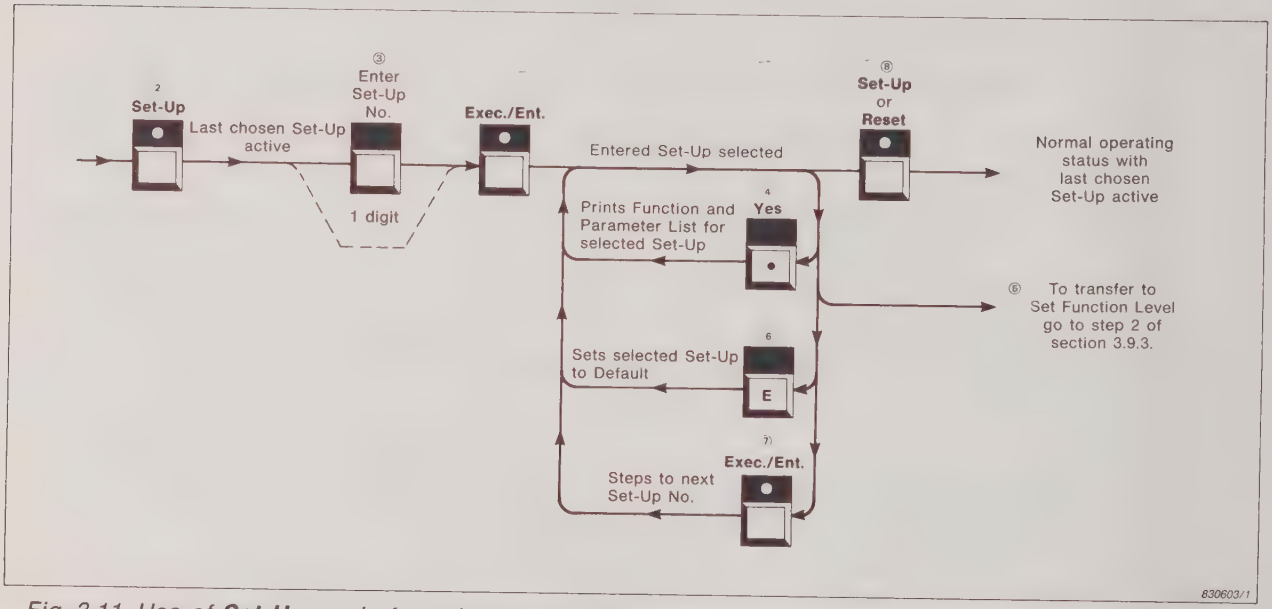


*Fig. 3.11. Use of **Set-Up** mode for selecting and listing of Operating Set-Ups and setting them to default*

1. Select **Power On**. Either the **Active** or **Entering Lamp** will light, and the date and time set with the internal clock printed.

```
DATE: 1984-02-12     TIME: 10:48:16
```

If `CONTINUOUS MEMORY AND CLOCK CLEARED` and/or `DATE: 9999 -01-01` is printed, check that the internal Ni-Cd battery for the continuous memory is connected before proceeding with step 2. See section 3.4.

2. Press **Set-Up** to activate the set-up mode and to print the identity of operating set-up selected. At the same time the **Set-Up** and **Entering Lamps** will light and, if previously alight, the **Active Lamp** extinguished.

```
Setup mode, active setup no: 1
```

3. Enter the number **[0, 1, 2 or 3]** of the particular set-up desired for operation and press **Exec./Ent.** to select the set-up. Alternatively, if the desired set-up is already active, press **Ent./Ent.** only. The identity of the set-up will be printed.

```
SELECTED SETUP NO: 2
```

Steps 4 to 8 may be performed at the user's discretion.

4. For a complete list of the operating functions, parameters and values set with the chosen set-up (see Fig. 3.9), press **Yes**.

5. To set one or more of the operating functions of the set-up to default or alter the parameters values of a particular function, go to step 2 of section 3.9.3 and 3.9.4 respectively.

6. To set the entire set-up to the default values set with the DEFAULT SET–UP NO: 0, press **[E]**. The following is printed:

```
Selected setup changed to default
```

7. If another set-up is preferred for operation or must be set to default, use the **Exec./Ent.** pushkey to step through each set-up in turn, until the required set-up is selected.

```
SELECTED SETUP NO: 1
SELECTED SETUP NO: 0
SELECTED SETUP NO: 3
```

8. To return the 2313 to normal standby status with the last chosen set-up selected, press **Set-Up** or **Reset**. The **Set-Up Lamp** should be extinguished and either the **Active** or **Entering Lamp** light again.

3.9.3. Selecting a Function

The "Set Function Level" of the **Set–Up** mode is useful for listing and setting one or more complete control functions of the different Operating Set-Ups to default. The appropriate pushkey sequence employed is as described below and is shown in Fig.3.12.

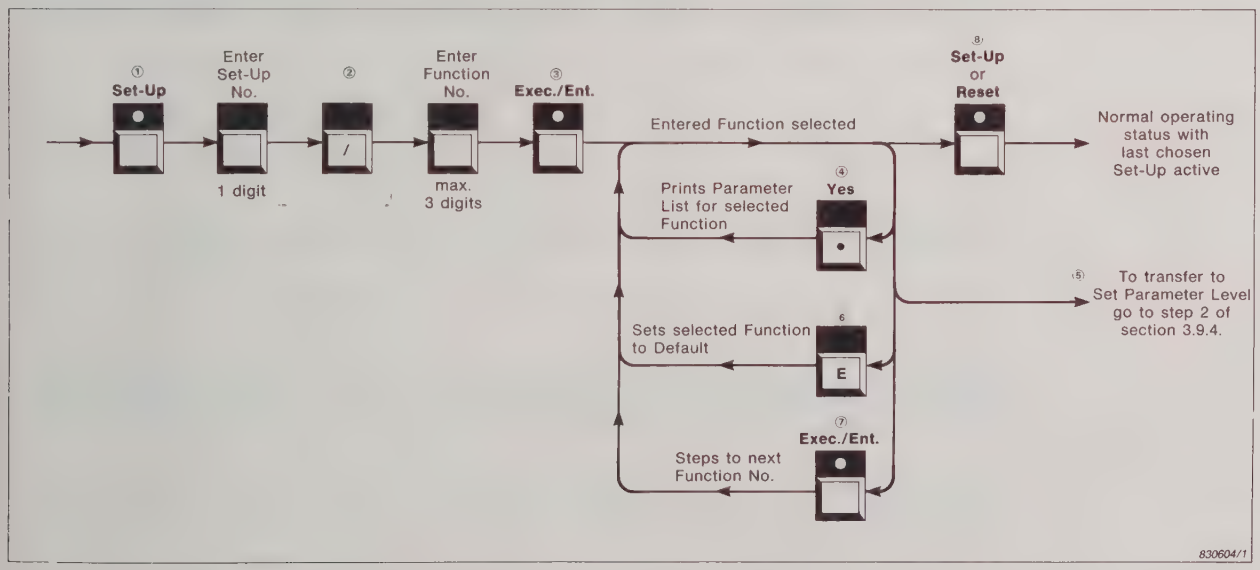


*Fig. 3.12. Use of **Set-Up** mode for selecting and listing of Operating Set-Up Functions plus setting the individual functions to default*

1. Press the **Set-Up** pushkey and enter the number **[0 to 3]** of the particular set-up required for operation e.g.

2. Press **Extension[/]** and enter the number **[0 to 201]** of the particular operating function of interest. e.g.

   To correct a false entry, press **Clear Entry** to delete, and re-enter the **[Set–Up Number] [/] [Function Number]**.

Note: If the required set-up has already been selected as in section 3.9.2, then only the **[Function Number]** should be entered.

3. Press **Exec./Ent.** to select the entered Set-Up and Function, plus print their identity.

```
SELECTED SETUP NO: 1
2 Memory
```

   Steps 4 to 8 may be carried out at the user's discretion.

4. For a list of the parameter values set with the selected function, press **Yes**.

```
SELECTED SETUP NO: 1

  FUNCTION              PARAMETER                    VALUE        UNIT
2 Memory             1 Store — secured :            —1          —1
```

5. To alter one or more of the parameter values of the function, go to step 2 of section 3.9.4.

6. To set the function to the default values set with the corresponding function of the DEFAULT SET–UP NO: 0, press **[E]**. The following is printed:

```
Selected function changed to default
```

7. If another function must be set to default, use the **Exec./Ent.** pushkey to step through each function in turn, until the required function is selected.

```
8 Contour plot
6 Delete
3 Cont. memory
```

8. To return the 2313 to normal operation with the above chosen set-up selected, press **Set-Up** or **Reset**. The **Set-Up Lamp** should be extinguished and either the **Active** or **Entering Lamp** light again.

3.9.4 Selecting Parameter and Parameter Value(s)

The "Set Parameter Level" of the **Set–Up** mode is used for selection and alteration of individual control function parameters within the Operating Set-Ups. The values and units to which the parameters may be individually set, depend on the particular control function to which they belong and are as specified in section 4.2 and 4.3.

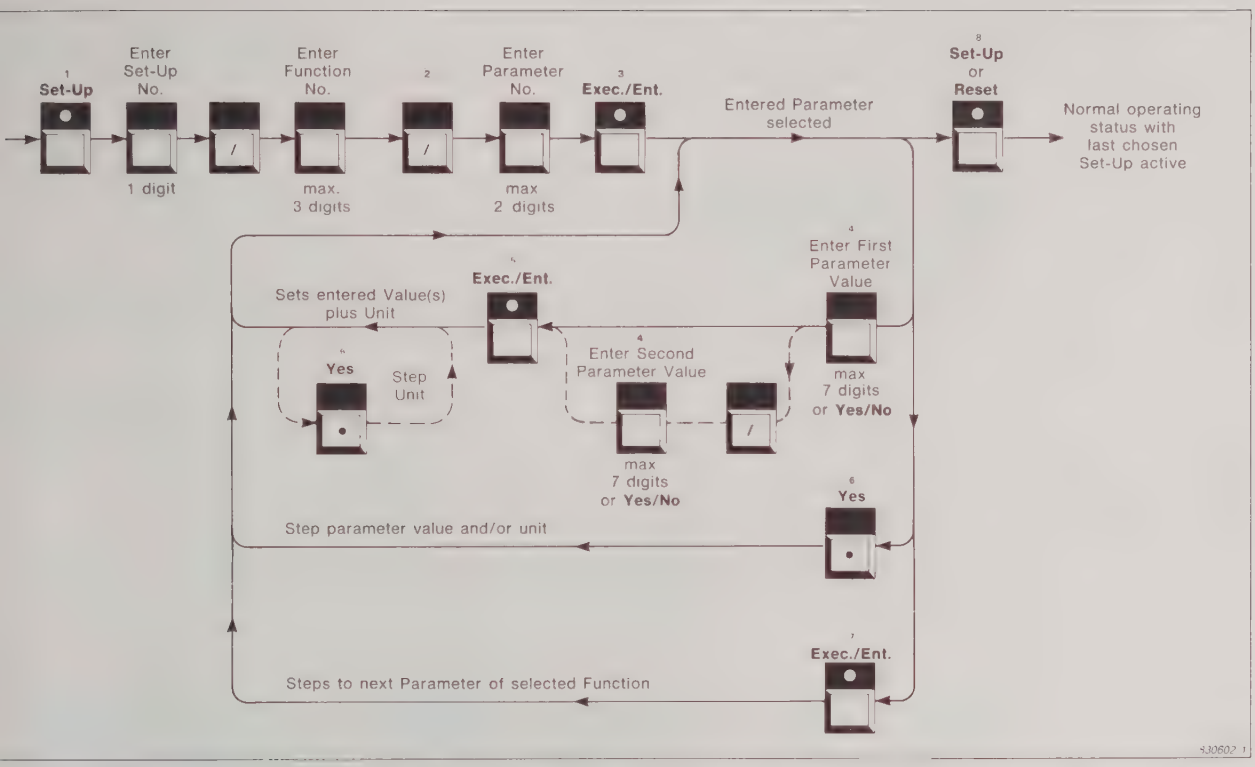
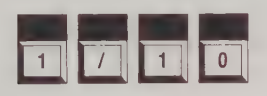


*Fig. 3.13. Use of the **Set-Up** mode for selecting Operating Set-Up parameters plus changing individual parameter values and units*

1. Press the **Set-Up** pushkey and enter the **[Set-Up Number] [/] [Function Number]** of interest e.g.



2. Press **Extension[/]** and enter the number **[1 to 9]** of the particular parameter of interest e.g.

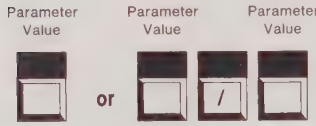
To correct a false entry, press **Clear Entry** to delete, and re-enter the **[Set–Up Number] [/] [Function Number] [/] [Parameter Number]**.

Note: If the required set-up and function have already been selected as in section 3.9.3, then only the **[Parameter Number]** should be entered.

3. Press **Exec./Ent.** to select the entered Set-Up, Function and Parameter, plus print their identity.

```
SELECTED SETUP NO: 1
10 Input spectra      5 7400 first meas. file :      1
```

4. To alter the parameter value, enter the new value (max. 5 digits or logic **Yes**, **No**). With parameters having two separate values, enter **Extension [/]** after the first value to permit entry of the second.



If unsure of which value to enter, press **Help** for a printout of acceptable values (ie. Parameter Value Check) plus details of current entry status. Alternatively, refer to section 4.2 for the particular function selected.

To correct a false entry, press **Clear Entry** to delete, and re-enter the correct value.

5. Press **Exec./Ent.** to set the value(s) entered, plus obtain a print out confirming the value(s) set:

```
10 Input spectra      5 7400 first meas. file :       10
```

If an incorrect value is entered, an error warning plus parameter value check will be printed e.g.

```
Parameter value not allowed                                  ERROR NO: 6

PARAMETER VALUE CHECK:
            1 < values < 31999
```

6. To change the parameter value unit repeatedly press **Yes** until the required unit is printed e.g.

```
202 Contour, 3D-plot      3 Frequency interval : 100   10000  Linear
202 Contour, 3D-plot      3 Frequency interval : 100   10000  A-weight
202 Contour, 3D-plot      3 Frequency interval : 100   10000  Linear
```

7. To step to another parameter of the selected function, ready for entry of new values as in steps 4 to 6, repeatedly press **Exec./Ent.** until the appropriate parameter is printed.

```
10 Input spectra      2 7400 read 3360 settings  : Yes
10 Input spectra      1 Channel selector freq.   :    1000          Hz
10 Input spectra      9 Separ. Lin. Averag. start: No
10 Input spectra      8 Partial remeasurement    : No
10 Input spectra      7 If from 3360 then -> 7400 : No
10 Input spectra      6 7400 spectrum type       : Sound Pres. : Ch. B
10 Input spectra      5 7400 first meas. file    :       10
```

8. To select another function and/or parameter, first return to normal operation by pressing **Set-Up** or **Reset**. The **Set-Up Lamp** should be extinguished and either the **Active** or **Entering Lamp** light again. Then repeat the above procedure i.e.:
[Set-up Number] [/] [Function] [/] [Parameter Number]

4. USE WITH SOUND INTENSITY ANALYSING SYSTEM TYPE 3360 DIGITAL FREQUENCY ANALYZER TYPE 2131 PLUS DIGITAL CASSETTE RECORDER TYPE 7400

4.1. BASIC ANALYSIS AND RECORDING SET-UP

The basic instrument set-ups for use of the Graphics Recorder Type 2313 plus Application Package BZ 7004 together with the Sound Intensity Analysing System Type 3360 or Digital Frequency Analyzer Type 2131 and/or Digital Cassette Recorder Type 7400, are shown in Figs. 4.1 & 4.2. Preparation of the instruments for analysis and recording is as described below.

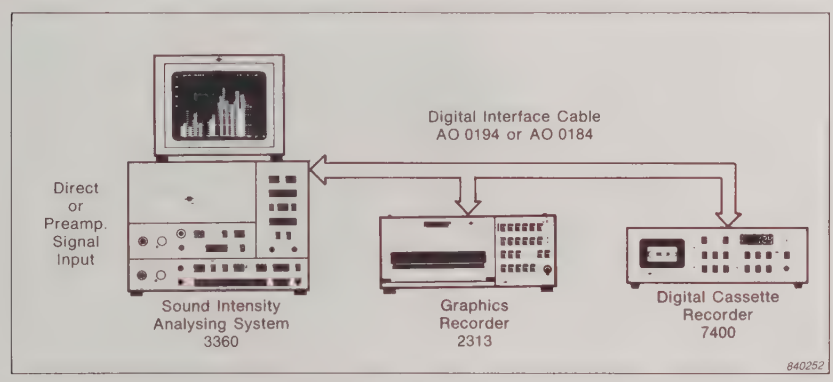


Fig. 4.1. Use of the 2313 Graphics Recorder with the 3360 Sound Intensity Analysing System and 7400 Digital Cassette Recorder

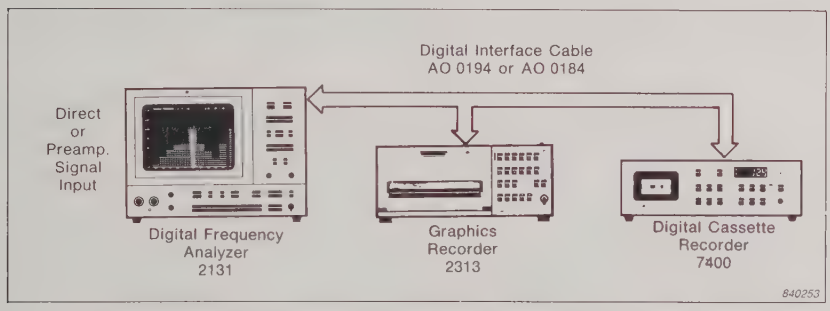


Fig. 4.2. Use of the 2313 Graphics Recorder with the 2131 Digital Frequency Analyzer and 7400 Digital Cassette Recorder

1. Fit the Graphics Recorder with an Application Package BZ 7004, Control Function Overlay SA 0304 and roll of Recording Paper QP 4690. Perform other preliminary adjustments if necessary. See Chapter 3.

2. Interconnect the **IEC 625 Interface Bus** connectors of the recording and analysing instrumentation as indicated in Figs. 4.1 & 4.2. If a Digital Cassette Recorder is employed in the set-up check that its **Interface Mode** switch is set to **"IEC"**. See Introduction of Chapter 6 for details on appropriate interface cable.

3. Check that the "System Controller Active" mode (**Address Switch** pair **8**) and appropriate "Metric" or "English" chart length are selected (**Address Switch** pair **7**) on the rear panel of the Graphics Recorder (see Fig.4.3) e.g.

   Address Switch pairs **8** to **1** on the **2313** to **"10X00001"**. The setting of switch 6 does not matter.

   Similarly, to permit communication with the other instruments in the setup set:

   Address Switch pairs **6** to **2** on the 3360 or 2131 to **"11000"**
   Multiswitch pairs **3** to **6** on the 7400 to **"0111"**

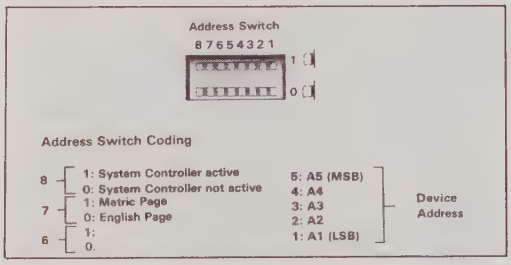


Fig. 4.3. Selection of "System Controller Active/Not Active", plus "Metric" and "English" chart length with the ***Address Switch*** *of the 2313*

4. Switch **Power On**, and press **Reset** on the Graphics Recorder. The 2313 will then print the date and time set with its internal clock and the **Active Lamp** will light indicating that the 2313 is ready for use as a system controller.

   Note: If `CONTINUOUS MEMORY AND CLOCK CLEARED` and/or `DATE: 9999-01-01` is printed, check that the internal Ni-Cd battery of the Graphics Recorder memory is connected before proceeding with step 5. See section 3.4.

5. Using the **Set-Up** key of the Recorder, activate the Set-Up mode to set correct date and time with the built-in clock and select the Set-Up required for recording measurements. See section 3.9.

6. Apply the signal to be analysed and set the controls of the analyser to produce a suitable octave or third octave frequency spectrum of the signal on the display screen.

7. Fit the Digital Cassette Recorder with a Tape Cassette ready for recording and/or replay of measurements from the Sound Intensity Analysing System Type 3360 or the Digital Frequency Analyzer Type 2131.

The measurement set-up is now ready for use with the IEC interface and front panel pushkeys of the Graphics Recorder exercising full control over the other instruments in the setup. Details on how to transfer measurement data from one instrument to another and how to use the control functions are given in section 4.2 and 4.3.

Note: For correct operation with the 2313, both the 3360 and the 2131 must be set to read out in Format I (see the relevant Instruction Manual).

4.2. CONTROL FUNCTIONS

The basic syntax for documenting, storing and processing of measurement data with the 2313 is the same regardless of which application package is employed. First the DESTINATION of the data must be entered and then the SOURCE of the data e.g.

	DESTINATION	SOURCE	
	[Input Spectra]	***[3360]***	**[Exec./Ent.]**
or	**[List]**	***[3360]***	**[Exec./Ent.]**
or	**[Plot]**	***[Memory]*** **[/]** [file no.]	**[Exec./Ent.]**
or	**[7400]** [file no.]	**[/]** ***[Memory]*** **[/]** [file no.]	**[Exec./Ent.]**

Data destination and source
DESTINATIONs are denoted by the functions printed in **plain** text on the Control Function Overlay. After a function is entered, the **Active Lamp** is extinguished and the **Entering Lamp** is lighted instead. This indicates that the 2313 is ready to receive information on the SOURCE which is denoted by the sub-functions printed in ***italic*** text on the Overlay. Alternatively, numbers can be entered for specifying which memory or tape file a measurement is to be sent to, provided that the numbers are followed by **Extension [/]** to permit entry of the SOURCE. If no SOURCE is specified then ***3360*** is automatically chosen, while if no memory or tape file number is specified for output of a stored or recorded measurement, then memory file 0 or the currently selected tape file is selected.

Repetition of measurement task
Once a specific documentation, storage or measurement task has been executed, and the **Active Lamp** of the 2313 is relighted, the same task can be repeated simply by pressing the **Exec./Ent.** pushkey. At the same time this will automatically update the memory or tape file locations of the DESTINATION and SOURCE so that next file is chosen. Thus a whole series of separate measurements may be documented or stored in successive memory or tape files without having to re-enter the entire pushkey sequence each time.

Help information
A false entry may be corrected prior to execution simply by pressing the **Clear Entry** pushkey and entering the entire sequence afresh. Similarly, execution of an unwanted function or task can be terminated by activating the **Reset** key. Where there is doubt about which function, sub-function and file numbers have been entered, the current status of the entry can be printed by activating **Help**.

4.2.1. List [0] – Function No: 0

With the **List** function of the 2313 measurements displayed on the analyser can be documented as shown in Fig. 4.4. Either octave or third octave measurement data is printed, depending on the **Filter Bandwidth** setting chosen on the analyser. Also, details on instrument control settings, personal text, plus the date and time of each readout are printed as part of the documentation heading. Note that an overload indication is only given in the sound pressure mode and not the sound intensity mode.

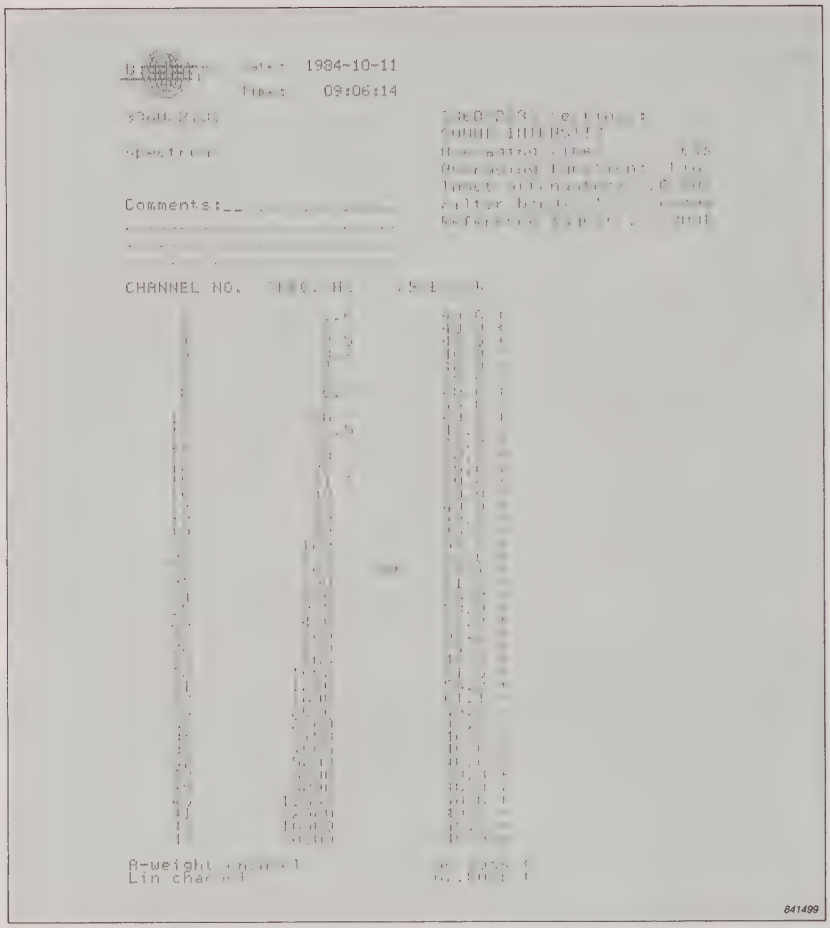


Fig. 4.4. Typical octave listing of sound intensity data measured with the Sound Intensity Analysing System Type 3360. The "+" and "–" signs after the levels indicate the direction of the sound intensity.

Parameters

The user accessible parameters controlling documentation produced by the **List** function have the parameter numbers and identities specified below. These are accessible with Set-Ups No: 1, 2 and 3 of the 2313 and to suit different types of measurement may be used to alter the readout by assigning them the parameter values indicated.

FUNCTION	PARAMETER	VALUE	UNIT
0 List	1 List from	0	Hz
0 List	2 List to	22000	Hz
0 List	3 Including head	YES	

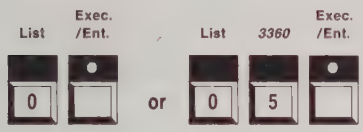
1–List from and **2–List to:** Accept any value between 0 and 22000 Hz with default at 0 and 22000 Hz respectively. They define filter centre frequency range over which measurements are listed. Entry of a decimal value is automatically rounded to the nearest whole number by the 2313.

3–Including head: Accepts logic **Yes** or **No**, with **Yes** as default. It determines whether or not instrument control settings, comments and personal text etc., are used to head listed measurements. It has no affect on readout of date and time which is always printed to facilitate future reference.

For further details on the use of Set-Ups No: 1, 2 and 3 refer to section 3.9.

Basic Pushkey Commands

To list measurements from the analyser use either of the following pushkey sequences:

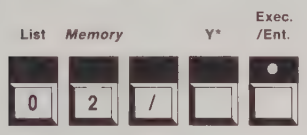


After readout of a complete listing, a second or third measurement etc. may be listed simply by pressing **Exec./Ent.** Alternatively, an extra copy of the previous measurement may be obtained by entering:

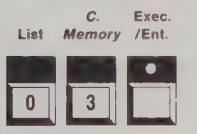
Recalls previous measurement from the 2313 Last Memory

The contents of the Memory or Continuous Memory of the 2313 can also be listed using the pushkey sequences illustrated below. Also given are sequences for listing measurements recorded on tape using the 2313 together with the 7400 Digital Cassette Recorder. For tape recorded measurements which have been recorded directly from the analyser without aid of the 2313, the recorded data must first be converted using the ***7400 File to BZ 7004 File*** function of the 2313 (see section 4.2.20).

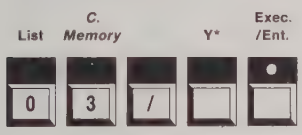
Lists measurement stored in 2312 Memory file 0



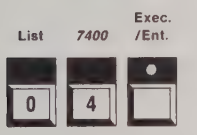
Lists measurement stored in 2313 Memory file Y



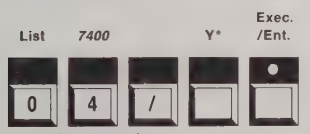
Lists measurement stoted in 2313 C. Memory file 0



Lists measurement stored in 2313 C. Memory file Y



Lists measurment stored in currently selected 7400 file



Lists measurement stored in 7400 file Y

* numeric entry only

where Y can be assigned any memory file number between 0 and 31999 or tape file number between 1 and the highest file number allocated on the 7400

After each readout List can be reactivated simply by pressing the **Exec./Ent** pushkey. This will list the measurement stored in the next file, thus making it possible to document a second or third stored measurement etc. without having to enter the entire pushkey sequence each time. Any attempt to access a non existent file will result in an error message being printed, and will return the 2313 to normal standby status. To list subsequent files a new pushkey sequence must be entered afresh.

Use With Other Functions

In addition to the above, the 2313 can be used to list measurements processed using ***Surface***, ***Last***, ***3360***, ***1/12 Octave***, ***Memory***, ***C. Memory***, ***7400***, ***Sound Power***, ***Subtract*** and ***Add*** subfunctions plus the ***Print Lin and A*** common-functions. These are discussed in later sections of this chapter which also include examples of the types of readout obtained.

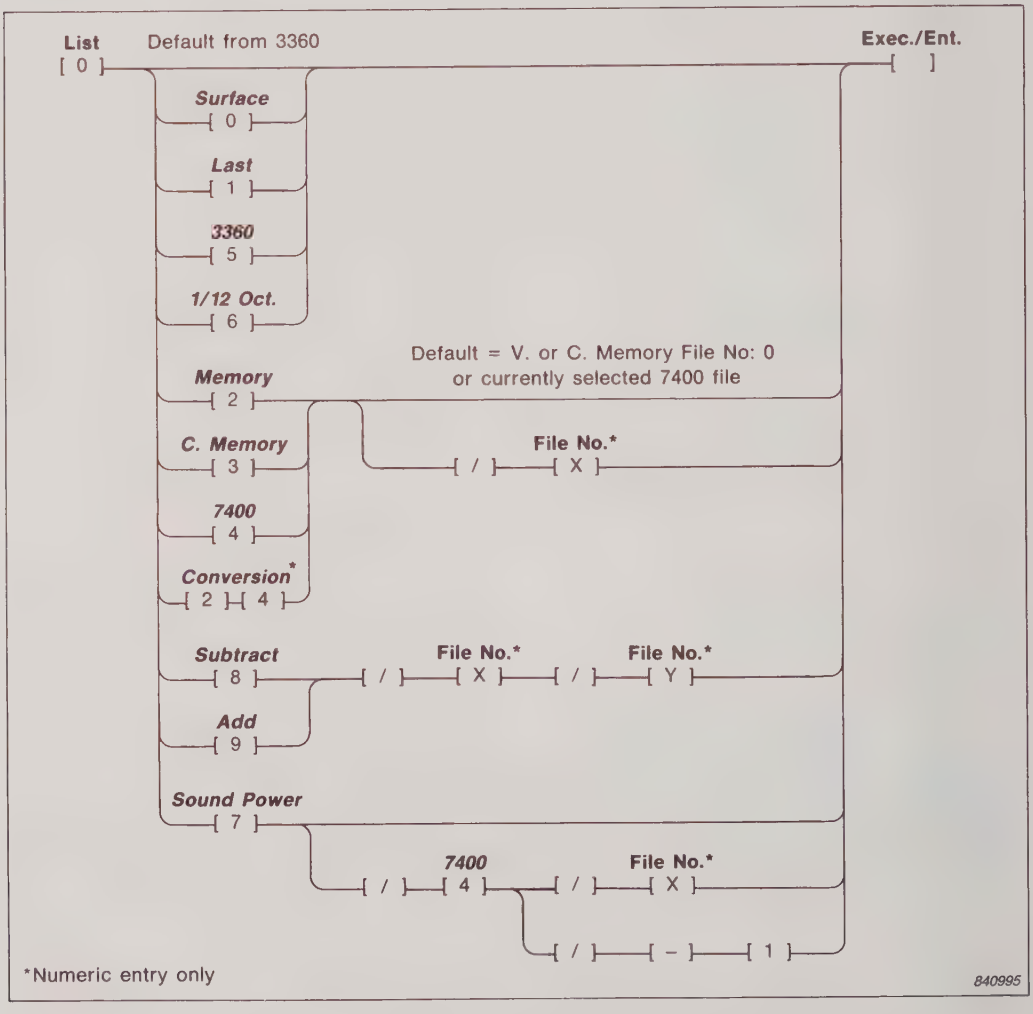


Fig. 4.5. Chart for all usable pushkey sequences beginning with **List**

List

Function	Para. 0	Para. 1	Para. 2		Destination	Source
[List]				[Exec.]	Printer	3360
[List]	[*Surface*]			[Exec.]	Printer	Surf. memory
[List]	[*Last*]			[Exec.]	Printer	Last
[List]	[*Memory*]			[Exec.]	Printer	Memory 0
[List]	[*Memory*]	[/] [X]		[Exec.]	Printer	Memory X
[List]	[*Cont. Memory*]			[Exec.]	Printer	C. memory 0
[List]	[*Cont. Memory*]	[/] [X]		[Exec.]	Printer	C. memory X
[List]	[*7400*]			[Exec.]	Printer	7400 file P
[List]	[*7400*]	[/] [X]		[Exec.]	Printer	7400 file X
[List]	[*3360*]			[Exec.]	Printer	3360
[List]	[*1/12*]			[Exec.]	Printer	3360
[List]	[*Sound power*]			[Exec.]	Printer	Mem. 101→
[List]	[*Sound power*]	[/] [7400]		[Exec.]	Printer	7400 file P→
[List]	[*Sound power*]	[/] [7400]	[/] [Y]	[Exec.]	Printer	7400 file Y→
[List]	[*Sound power*]	[/] [7400]	[/] [–] [1]	[Exec.]	Printer	7400 L-M→
[List]	[*Subtract*]	[/] [X]	[/] [Y]	[Exec.]	Printer	Mem.X–Mem.Y
[List]	[*Add*]	[/] [X]	[/] [Y]	[Exec.]	Printer	Mem.X+Mem.Y
[List]	[*2*] [*4*]			[Exec.]	Printer	7400 file P
[List]	[*2*] [*4*]	[/] [X]		[Exec.]	Printer	7400 file X

Parameter interval:
X, Y: 0 – 31999
P: File at tape position.

Remarks:
→: Uses all relevant subsequent files.
L-M→ Winds forward to the last file on tape and then rewinds the specified number of files which are then used sequentially.

T00447GB0

Table 4.1. All usable pushkey sequences beginning with **List**

4.2.2. Plot [1] – Function No: 1

The **Plot** function generates fully annotated graphic plots of measurements displayed on 3360. These are similar to that shown in Fig. 4.6 and by choosing the appropriate **Filter Bandwidth** setting on the analyser, either octave or third octave measurements can be documented. As with the **List** function a date and time plus instrument control setting heading are printed and there is space for entry of personal text and comments. The measured level and filter centre frequency axes printed are graduated in terms of dB re 1 μV and Hz respectively with the maximum level being marked by an arrow both at the top and bottom of the corresponding frequency band on the chart. Any attempt to plot a sound pressure measurement whilst the analyser is overloaded by input signals of too high a peak level will result in an overload warning being printed beneath the control setting heading. Also the measurement will be plotted using a paler raster. No overload indication is given for sound intensity measurements.

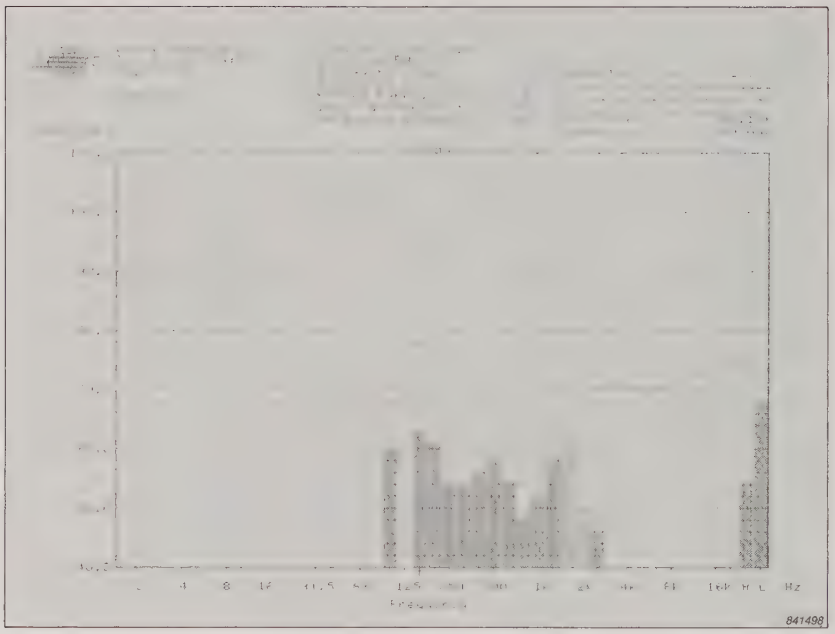


Fig. 4.6. Typical third octave plot of sound intensity data

Parameters

The user accessible parameters controlling documentation produced by the **Plot** function have the parameter numbers and identities specified below. These are accessible with Operating Set-Ups No: 1, 2 and 3 of the 2313 and to suit different types of measurement may be used to alter the readout by assigning them the parameter values indicated.

FUNCTION	PARAMETER		VALUE	UNIT
1 Plot	1 Graphic offset	:	0	dB
1 Plot	2 Scale proportion, 25dB/	:	5	cm
1 Plot	3 Plot from	:	0	Hz
1 Plot	4 Plot to	:	22000	Hz

1–Graphic offset: Accepts values between 0 and 50 dB in 5 dB increments and on default is set to 0 dB. Is used to lift the vertical axes so that measurements plotted with scale proportion of 25 dB/10 cm and 25 dB/20 cm can be properly documented without being clipped. For measurements plotted with a scale proportion of 25 dB/5 cm, use of the default value 0 dB is recommended.

2–Scale proportion, 25 dB/: Accepts values of 5, 10 and 25 cm with 5 cm as default. It sets the scale proportion of the vertical axes giving corresponding amplitude ranges of 70, 35 and 17,5 dB respectively.

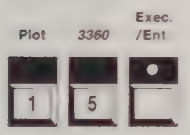
3–Plot from and **4–Plot to:** Accept any value between 0 and 22 000 Hz with default at 0 and 22 000 Hz respectively. They define filter centre frequency range over which measurements are plotted. Entry of a decimal value is automatically rounded to the nearest whole number by the 2313.

For further details on the use of Set-Ups, section 3.9 should be consulted.

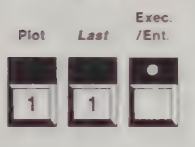
Basic Pushkey Commands

The basic pushkey commands for documenting measurements with the **Plot** function are given below. These are very similar to those used for listing measurements and therefore section 4.2.1 should be consulted where a more detailed explanation is required.

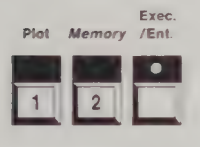
Plots measurement displayed on the 3360



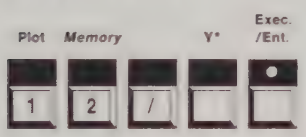
Plots measurement displayed on the 3360



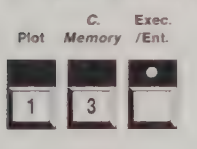
Plots previous measurement recalled from 2313 Last Memory



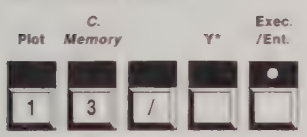
Plots measurement stored in 2313 Memory file 0



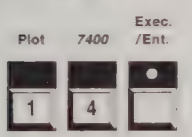
Plots measurement stored in 2313 Memory file Y



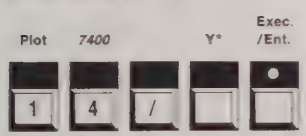
Plot measurement stored in 2313 C. Memory file 0



Plot measurement stored in 2313 C. Memory file Y



Plots measurment stored in currently selected 7400 file



Plots measurement stored in 7400 file Y

where Y can be assigned any memory file number between 0 and 31999 or tape file number between 1 and the highest file number allocated on the 7400.

Use With Other Functions

In addition to the above, the 2313 can be used to list measurements processed using ***1/12 Octave, Contour Plot, 3D Plot, Sound Power, Subtract*** and sub-functions plus ***Add, Print Lin and A*** common functions. These are discussed in later sections of this chapter which also include examples of the types of readout obtained.

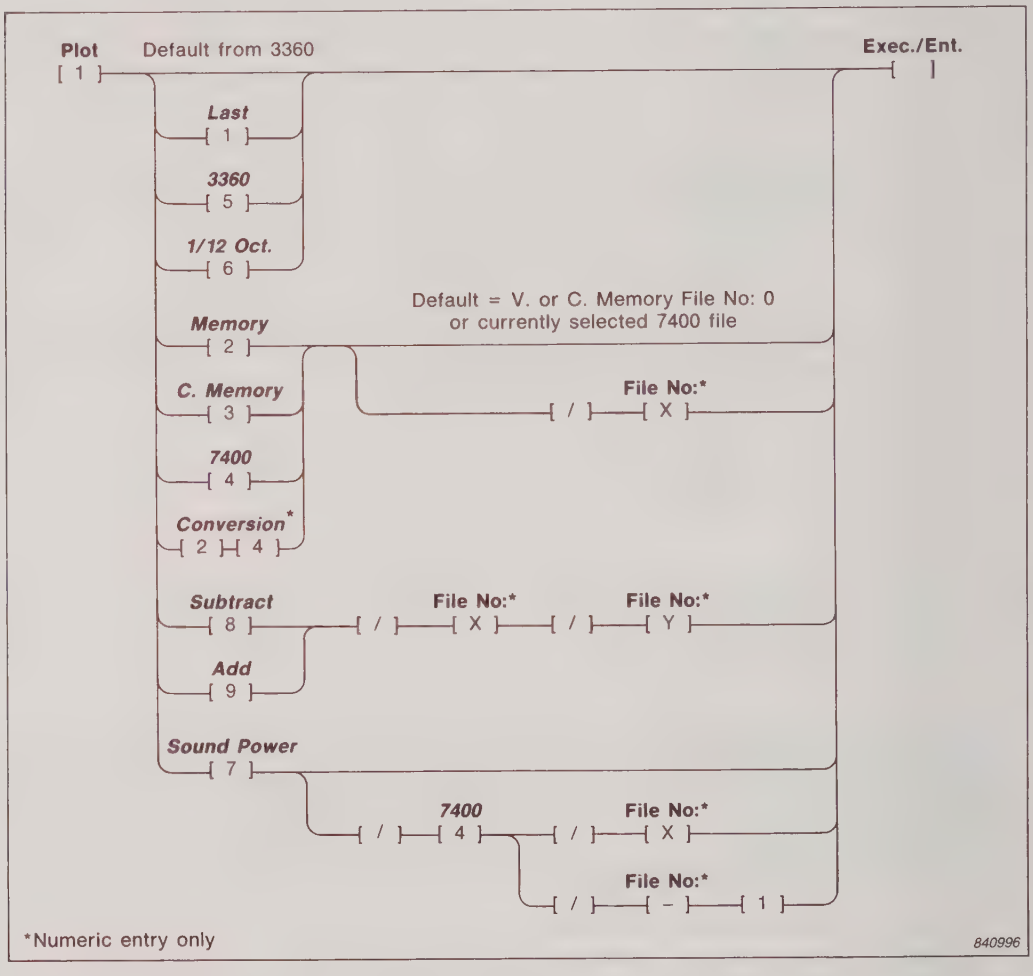


Fig. 4.7. Chart for all usable pushkey sequences beginning with **Plot**

Plot

Function	Para. 0	Para. 1	Para. 2		Destination	Source
[Plot]				[Exec.]	Printer	3360
[Plot]	[*Last*]			[Exec.]	Printer	Last
[Plot]	[*Memory*]			[Exec.]	Printer	Memory 0
[Plot]	[*Memory*]	[/] [X]		[Exec.]	Printer	Memory X
[Plot]	[*Cont. Memory*]			[Exec.]	Printer	C. Memory 0
[Plot]	[*Cont. Memory*]	[/] [X]		[Exec.]	Printer	C. memory X
[Plot]	[*7400*]			[Exec.]	Printer	7400 file P
[Plot]	[*7400*]	[/] [X]		[Exec.]	Printer	7400 file X
[Plot]	[*3360*]			[Exec.]	Printer	3360
[Plot]	[*1/12*]			[Exec.]	Printer	3360
[Plot]	[*Sound power*]			[Exec.]	Printer	Mem. 101→
[Plot]	[*Sound power*]	[/] [7400]		[Exec.]	Printer	7400 file P→
[Plot]	[*Sound power*]	[/] [7400]	[/][Y]	[Exec.]	Printer	7400 file Y→
[Plot]	[*Sound power*]	[/] [7400]	[/][–][1]	[Exec.]	Printer	7400 L-M→
[Plot]	[*Subtract*]	[/] [X]	[/][Y]	[Exec.]	Printer	Mem.X–Mem.Y
[Plot]	[*Add*]	[/] [X]	[/][Y]	[Exec.]	Printer	Mem.X+Mem.Y
[Plot]	[*2*][*4*]			[Exec.]	Printer	7400 file P
[Plot]	[*2*][*4*]	[/] [X]		[Exec.]	Printer	7400 file X

Parameter interval: X, Y: 0 – 31999
P: File at tape position.

Remarks: →: Uses all relevant, subsequent files
L-M→: Winds forward to the last file on tape and then rewinds the specified number of files which are then used sequentially

T00450GB0

Table 4.2. All usable pushkey sequences beginning with **Plot**

4.2.3. Move to Memory [2] – Function No: 2

The **Memory** function of the 2313 enables measurement spectra and control setting information etc. to be stored for future use. This memory is volatile and therefore data may be retained here only as long as the 2313 is powered. Not only can stored measurements be retained for later use, but they can also be outputted to other digital equipment or be subjected to further processing by 2313. The maximum number measurements which may be filed depends on the type of measurement and is as follows:

302 1/1 octave measurements
or 228 1/3 octave measurements
or 123 1/12 octave or other measurements

Parameters

To help safeguard stored measurements, Operating Set-Ups No: 1, 2 and 3 are equipped with the following control parameters:

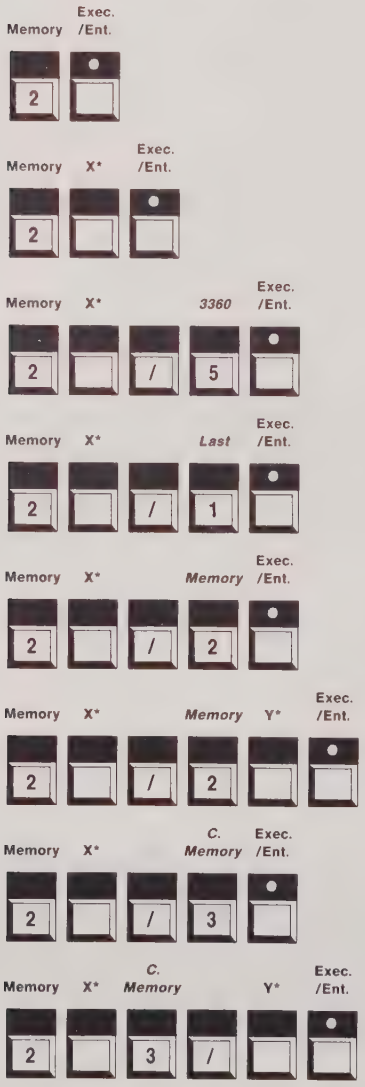
FUNCTION	PARAMETER		VALUE	UNIT
2 Memory	1 Store secured	:	–1	–1
3 Cont. memory	1 Store secured	:	–1	–1
6 Delete	1 Memory secured	:	–1	–1
6 Delete	2 Cont. memory secured	:	–1	–1

These accept values between 0 and 31999 and permit any group of consecutive memory files to be store- or delete-secured simply by entering the numbers of the first and last files of the group to be protected. The default value of –1 indicates that the function is inoperative. Also vacant files can be secured so that once a measurement has been stored in a vacant file, subsequent attempts to delete or store new data in the same file will be blocked by the Recorder.

Note that files only remain secured whilst operating with the particular Operating Set-Up in which they are store and delete secured. Consequently, for reliable protection of stored data, it is important that the same files secured with Set-Up No: 1, for example, are also secured with Set-Up No: 2 and 3. In Default Set-Up No: 0 it is not possible to secure stored data. In this case it is recommended that the **Memory Menu** function be used (see section 4.2.8) to provide a short-form listing of which files are already occupied. For further details on the use of Operating Set-Ups refer to section 3.9.

Basic Pushkey Commands

To store measurements in the volatile memory, use the following pushkey sequences:



Stores measurement in Memory file 0 from the 3360

Stores measurement in Memory file X from the 3360

Stores measurement in Memory file X from the 3360

Stores measurement in Memory file X from the 2313 Last Memory

Stores measurement in Memory file X from Memory file 0

Stores measurement in Memory file X from Memory file Y

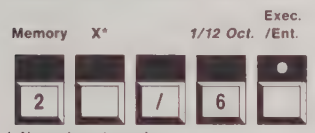
Stores measurement in Memory file X from C. Memory file 0

Stores measurement in Memory file X from C. Memory file Y

Stores measurement in Memory file X from currently selected 7400 file

Stores measurement in Memory file X from 7400 file Y

Stores measurement in Memory file X from the 3360

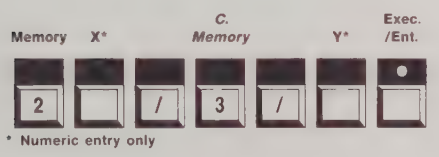


Actuates 4-pass 1/12 octave analysis storing results in Memory file X

* Numeric entry only

where X and Y can be assigned any memory file number between 0 and 31999 or tape file number between 1 and the highest file number allocated on the 7400.

Pressing **Exec./Ent.** a second or third time after entry of any of the above sequences automatically updates the file numbers storing data in the next adjacent file provided this is free for storing measurements. e.g.



* Numeric entry only

Stores measurement in V. Memory file X from C. Memory file Y

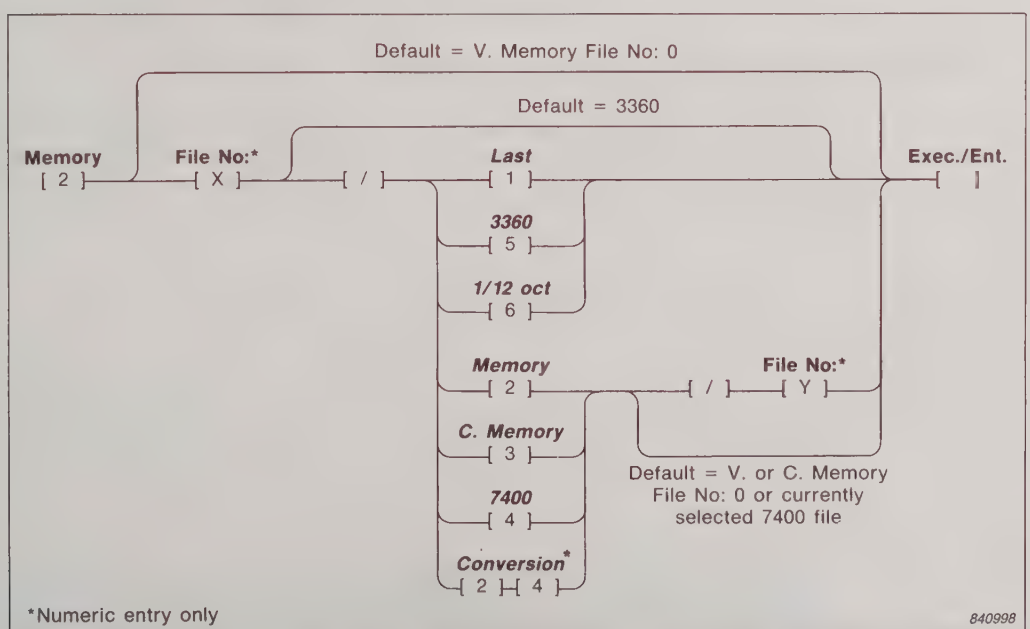


Fig. 4.8. Chart for all usable pushkey sequences beginning with **Memory**

Exec.
/Ent.

etc.

Stores measurment in V. Memory file X + n from C. Memory file Y + n, where "n" is the number of times **Exec./Ent** is pressed

Any attempt to store data in a store-secured file already containing data or transfering data from an empty file will permanently interrupt the above sequence and print an error message.

Move to Memory

Function	Para. 0	Para. 1	Para. 2		Destination	Source
[Memory]				[Exec.]	Memory 0	3360
[Memory]	[X]			[Exec.]	Memory 0	3360
[Memory]	[X]	[/] [*Last*]		[Exec.]	Memory X	Last
[Memory]	[X]	[/] [*Memory*]		[Exec.]	Memory X	Memory 0
[Memory]	[X]	[/] [*Memory*]	[/][Y]	[Exec.]	Memory X	Memory Y
[Memory]	[X]	[/] [*Cont. Memory*]		[Exec.]	Memory X	C. Memory 0
[Memory]	[X]	[/] [*Cont. Memory*]	[/][Y]	[Exec.]	Memory X	C. Memory Y
[Memory]	[X]	[/] [*7400*]		[Exec.]	Memory X	7400 file P
[Memory]	[X]	[/] [*7400*]	[/][Y]	[Exec.]	Memory X	7400 file Y
[Memory]	[X]	[/] [*3360*]		[Exec.]	Memory X	3360
[Memory]	[X]	[/] [*1/12*]		[Exec.]	Memory X	3360
[Memory]	[X]	[/] [*2*][*4*]		[Exec.]	Memory X	7400 file P
[Memory]	[X]	[/] [*2*][*4*]	[/][Y]	[Exec.]	Memory X	7400 file Y

Parameter interval:
X: 0 – 31999
Y: 0 – 31999
P: File at tape position.

T00451GB0

Table 4.3. All usable pushkey sequences beginning with **Memory**

4.2.4. Move to Continuous Memory [3] – Function No: 3

This is similar to the **Memory** function. An important difference is that measurements can be stored indefinitely, provided that the continuous memory is kept powered by the built-in Ni-Cd battery of the 2313 (see section 3.4). The maximum number of measurements which may be stored is as follows:

14 1/1 octave measurements
or 11 1/3 octave measurements
or 6 1/12 octave or other measurements

The pushkey commands used for storing measurements are the same as those indicated in section 4.2.3, except that the **C. Memory** pushkey is used to initiate each sequence instead of the **Memory** key. Likewise any group of successive memory files may be secured using the following control parameters which except for function and parameter numbers indicated are the same those described in section 4.2.3.

FUNCTION	PARAMETER		VALUE	UNIT
3 Contin. Memory	1 Store secured	:	—1	—1
6 Delete	2 Contin. memory secured	:	—1	—1

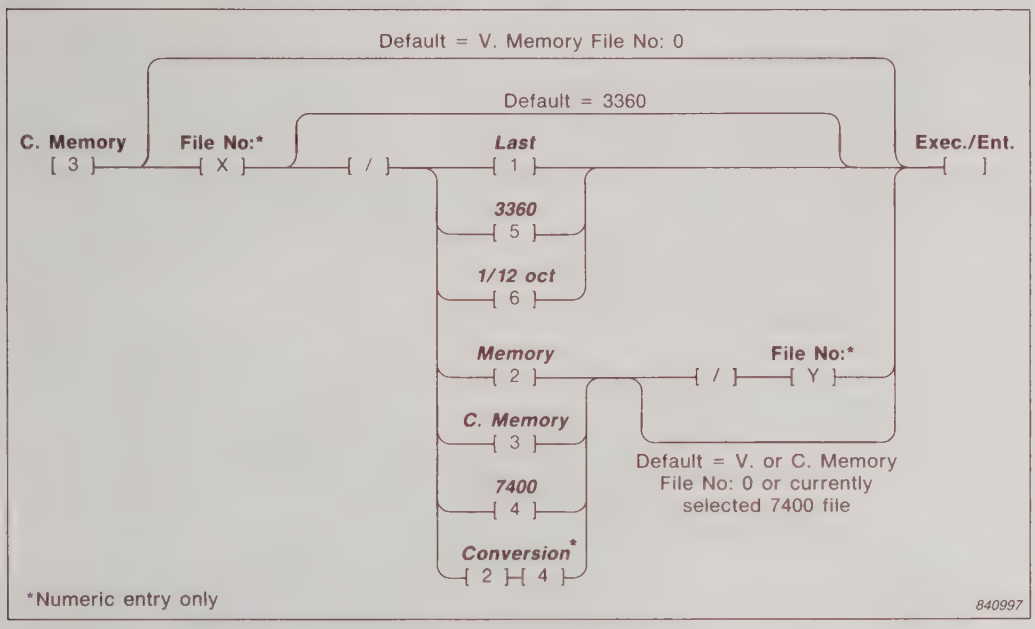


Fig. 4.9. Chart for all usable pushkey sequences beginning with **Cont. Memory**

Move to Cont. Memory							
Function	**Para. 0**	**Para. 1**	**Para. 2**		**Destination**	**Source**
[Cont. Memory]				**[Exec.]**	Cont. Memory	3360
[Cont. Memory]	**[X]**			**[Exec.]**	Cont. Memory	3360
[Cont. Memory]	**[X]**	**[/] [*Last*]**		**[Exec.]**	Cont. Memory	Last
[Cont. Memory]	**[X]**	**[/] [*Memory*]**		**[Exec.]**	Cont. Memory	Memory 0
[Cont. Memory]	**[X]**	**[/] [*Memory*]**	**[/][Y]**	**[Exec.]**	Cont. Memory	Memory Y
[Cont. Memory]	**[X]**	**[/] [*Cont. Memory*]**		**[Exec.]**	Cont. Memory	C. Memory 0
[Cont. Memory]	**[X]**	**[/] [*Cont. Memory*]**	**[/][Y]**	**[Exec.]**	Cont. Memory	C. Memory Y
[Cont. Memory]	**[X]**	**[/] [*7400*]**		**[Exec.]**	Cont. Memory	7400 file P
[Cont. Memory]	**[X]**	**[/] [*7400*]**	**[/][Y]**	**[Exec.]**	Cont. Memory	7400 file Y
[Cont. Memory]	**[X]**	**[/] [*3360*]**		**[Exec.]**	Cont. Memory	3360
[Cont. Memory]	**[X]**	**[/] [*1/12*]**		**[Exec.]**	Cont. Memory	3360
[Cont. Memory]	**[X]**	**[/] [*2*][*4*]**		**[Exec.]**	Cont. Memory	7400 file P
[Cont. Memory]	**[X]**	**[/] [*2*][*4*]**	**[/][Y]**	**[Exec.]**	Cont. Memory	7400 file Y

Parameter interval:
X: 0 – 31999
Y: 0 – 31999
P: File at tape position.

T00452GB0

Table 4.4. All usable pushkey sequences beginning with **Cont. Memory**

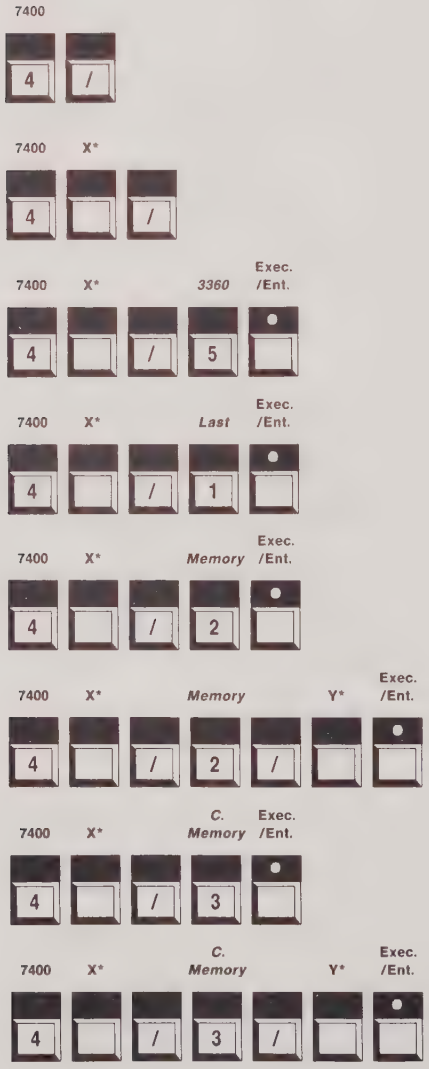
4.2.5. Move to 7400 [4] – Function No: 4

This function is useful for recording with the Digital Cassette Recorder Type 7400. Measurements presented on the display screen of the analyser can be recorded and also plus those stored or processed using 2313. The maximum number of measurements which can stored per side of a Digital Tape Cassette containing 300 m of tape is as follows:

1 200 1/1 octave measurements
or 900 1/3 octave measurements
or 500 1/12 octave or other measurements

Basic Pushkey Commands

For recording measurements in a 7400 file, the following pushkey sequences apply:



Records measurement in currently selected 7400 file from 3360

Records measurement in 7400 file X from 3360

Records measurement in 7400 file X from 3360

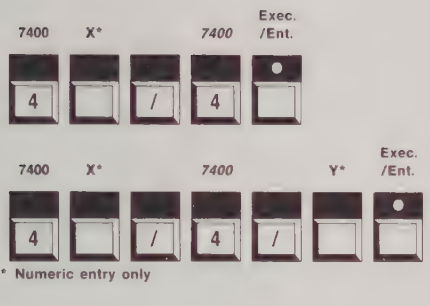
Records measurement in 7400 file X from 2313 Last Memory

Records measurement in 7400 file X from Memory file 0

Records measurement in 7400 file X from Memory file Y

Records measurement in 7400 file X from C. Memory file 0

Records measurement in 7400 file X from C. Memory file Y



Records measurement in 7400 file X from currently selected 7400 file

Records measurement in 7400 file X from 7400 file Y

where X and Y can be assigned any memory file number between 0 and 31 999 or tape file number from –1 to the highest used file number. With the 7400, measurements are recorded sequentially with File No: allocated by the Recorder. This means that when a blank Tape Cassette is fitted, no tape file number should be entered as the destination (i.e. File No: X) since the 7400 automaticaly selects file no: 1 for recording the first measurement, file no: 2 for the second measurement, and so on. If, however, a tape already containing recorded measurements is used then tape File No: –1 (i.e. **[–][1]**) should be entered as the destination. This will spool the tape to the end of the last previously recorded tape file before continuing to record a new measurement.

Pressing **Exec./Ent.** a second or third time after entry of any of the above sequences automatically updates the file numbers storing data in the next adjacent file provided this is free for storing measurements.

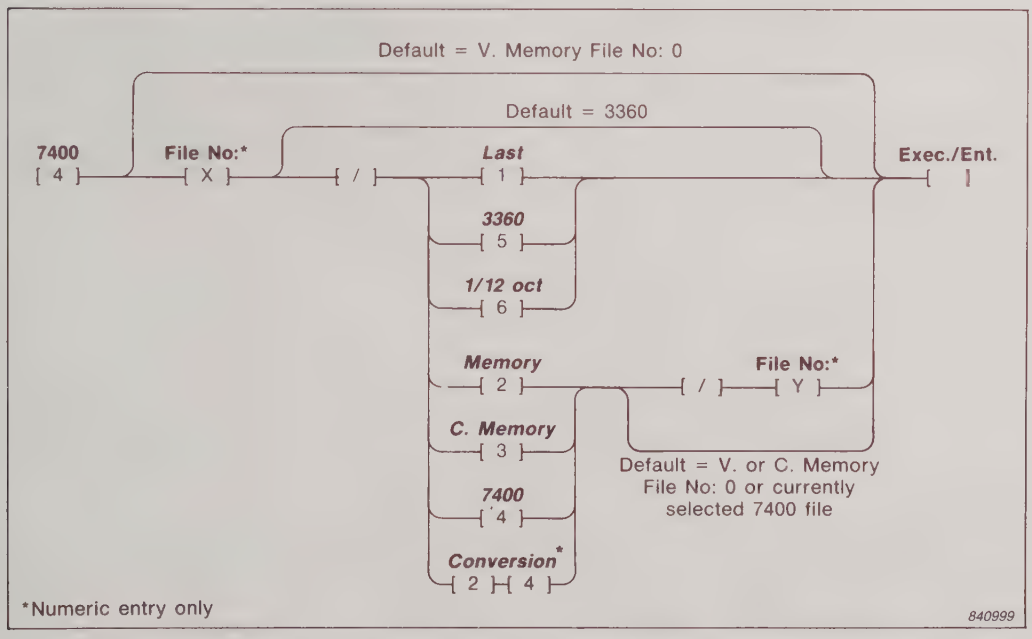


Fig. 4.10. Chart for all usable pushkey sequences beginning with **7400**

Move to 7400						
Function	**Para. 0**	**Para. 1**	**Para. 2**		**Destination**	**Source**
[7400]				[Exec.]	7400 file P	3360
[7400]	[X]			[Exec.]	7400 file X	3360
[7400]	[X]	[/] [*Last*]		[Exec.]	7400 file X	Last
[7400]	[X]	[/] [*Memory*]		[Exec.]	7400 file X	Memory 0
[7400]	[X]	[/] [*Memory*]	[/][Y]	[Exec.]	7400 file X	Memory Y
[7400]	[X]	[/] [*Cont. Memory*]		[Exec.]	7400 file X	C. Memory 0
[7400]	[X]	[/] [*Cont. Memory*]	[/][Y]	[Exec.]	7400 file X	C. Memory Y
[7400]	[X]	[/] [*7400*]		[Exec.]	7400 file X	7400 file P
[7400]	[X]	[/] [*7400*]	[/][Y]	[Exec.]	7400 file X	7400 file Y
[7400]	[X]	[/] [*3360*]		[Exec.]	7400 file X	3360
[7400]	[X]	[/] [*1/12*]		[Exec.]	7400 file X	3360
[7400]	[X]	[/] [*2*][*4*]		[Exec.]	7400 file X	7400 file P
[7400]	[X]	[/] [*2*][*4*]	[/][Y]	[Exec.]	7400 file X	7400 file Y

Parameter interval:
X: –1 – 31999
Y: 0 – 31999
P: File at tape position.

Remarks:
If X = –1 the 2313 begins to read spectra onto the 7400 after the last file on tape.
If X = 0 the 2313 reads spectra onto the 7400 at the tape position

T00453GB0

Table 4.5. All usable pushkey sequences beginning with **7400**

Tape File Substitution

Where it is required to delete a recorded measurement and substitue one from another tape or memory file, the file numbers of both the destination and source should be specified. With new 7400 Digital Cassette Recorders (from serial number 1091835) files containing measurements within the following groups may be substituted by another measurement file belonging to the same group:

Group 1: 1/1 octave spectra
Group 2: 1/3 octave spectra
Group 3: 1/12 octave spectra
Map file.

Measurement files may also be substituted with earlier 7400 Recorders (up to and including serial number 1091834). For this purpose the Recorders must be fitted with the File Substitution Option WH 1561 or Clock Option WH 1559.

Any attempt to record data in a write-protected file, or one which is not write protected but is too small, will permanently interrupt the above sequence and print an error message. A tape may be cleared to enable files to be recorded by pressing **[Delete] [–] [7400] [Exec. / Ent.]**.

4.2.6. Move to 3360 [5] – Function No: 5

The **Move to 3360** function permits stored measurements to be presented on the display screen of the 3360 or 2131. Following display of a measurement, the analyser can be returned to normal operating status by activating its **Input Spectrum Function "Cont."** key.

Basic Pushkey Commands

To display stored measurements on the 3360, enter one of the following:

Displays stored measurement from Memory file 0

Displays stored measurement from Memory file Y

The above commands may also be used for displaying measurements stored in either the Last or C. Memory of the 2313. Alternatively, measurements stored on tape with the 7400 may be displayed. For this purpose the ***Last***, ***C. Memory*** or ***7400*** pushkey should be activated instead of the ***Memory*** key.

Where a 4-pass 1/12 octave analysis is recalled using the above commands, Part 0 of the analysis will be displayed. For display of Parts 1, 2 and 3 the following command can be entered instead:

Displays Part P of stored measurement from Memory file Y

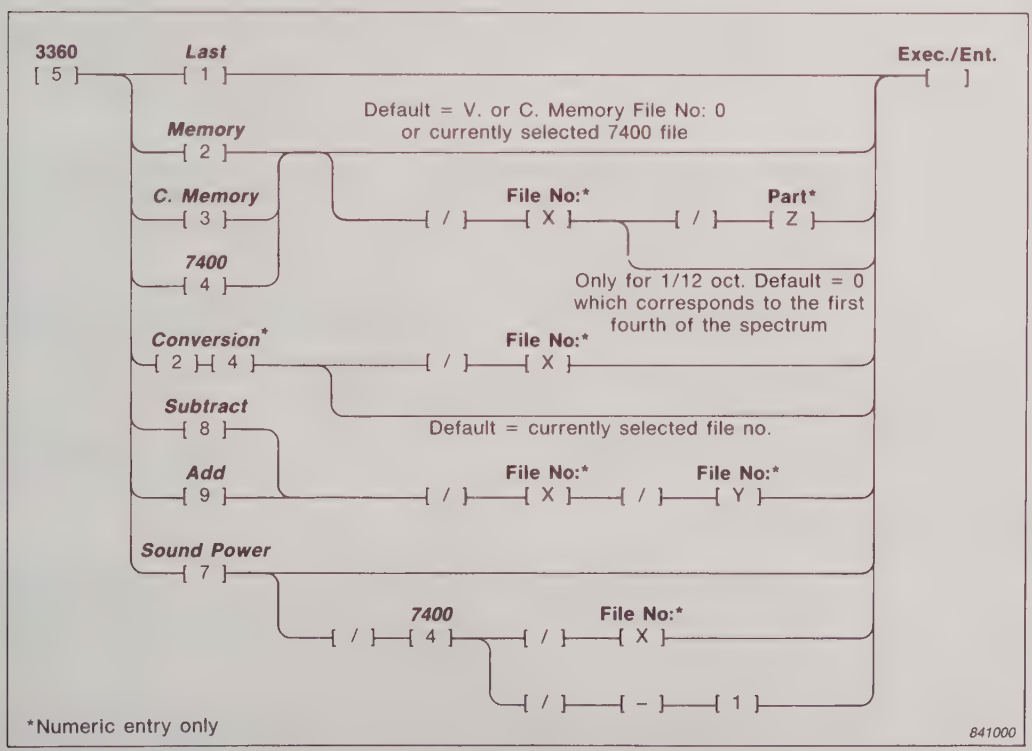


Fig. 4.11. Chart for all usable pushkey sequences beginning with **3360**

Move to 3360

Function	Para. 0	Para. 1	Para. 2		Destination	Source
[3360]				[Exec.]	3360	3360
[3360]	[*Last*]			[Exec.]	3360	Last
[3360]	[*Last*]	[/] [Part]		[Exec.]	3360	Last
[3360]	[*Memory*]			[Exec.]	3360	Memory 0
[3360]	[*Memory*]	[/] [Y]		[Exec.]	3360	Memory Y
[3360]	[*Memory*]	[/] [Y]	[/] [PART]	[Exec.]	3360	Memory Y
[3360]	[*Cont. Memory*]			[Exec.]	3360	C. Memory 0
[3360]	[*Cont. Memory*]	[/] [Y]		[Exec.]	3360	C. Memory Y
[3360]	[*Cont. Memory*]	[/] [Y]	[/] [PART]	[Exec.]	3360	C. Memory Y
[3360]	[*7400*]			[Exec.]	3360	7400 file P
[3360]	[*7400*]	[/] [Y]		[Exec.]	3360	7400 file Y
[3360]	[*3360*]			[Exec.]	3360	3360
[3360]	[*1/12*]			[Exec.]	3360	3360
[3360]	[*Sound Power*]			[Exec.]	3360	Memory 101→
[3360]	[*Sound Power*]	[/] [7400]		[Exec.]	3360	7400 file P→
[3360]	[*Sound Power*]	[/] [7400]	[/] [Y]	[Exec.]	3360	7400 file Y→
[3360]	[*Sound Power*]	[/] [7400]	[/] [–1]	[Exec.]	3360	7400 L-M→
[3360]	[*Subtract*]	[/] [X]	[/] [Y]	[Exec.]	3360	Mem.X–Mem.Y
[3360]	[*Add.*]	[/] [X]	[/] [Y]	[Exec.]	3360	Mem.X+Mem.Y
[3360]	[*2*] [*4*]			[Exec.]	3360	7400 file P
[3360]	[*2*] [*4*]	[/] [Y]		[Exec.]	3360	7400 file Y

Parameter interval:
PART: 0 – 3
X,Y: 0 – 31999
P: File at tape position.

Remarks:
→: Uses all relavant subsequent files.
L-M→ Winds forward to the last file on tape and then rewinds the specified number of files which are then used sequentially.

T00454GB0

Table 4.6. All usable pushkey sequences beginning with **3360**

Alternatively, following execution of a command it can be re-executed a second or third time etc., by pressing **Exec./Ent.** This will automatically select the next part of the measurement or the next memory file, thus enabling a whole series of measurements to be individually displayed without having to manually enter the entire command each time. Any attempt to display data from a non existant or empty file will permanently interrupt the sequence and produce an appropriate error message.

Note: The filter channel numbers indicated by the 3360 are valid for 1/1 and 1/3 octave measurements only. For 1/12 octave measurements the channel numbers given in section 4.2.15 apply.

4.2.7. Delete [6] – Function No: 6

The **Delete** function erases measurement data in any one or group of non delete-secured memory files of the 2313. In addition, it may be used to activate the 7400 Digital Cassette Recorder for erasing a complete side of a non-write protected Digital Tape Cassette.

Parameters

For securing consecutive Memory and Continuous Memory files of the 2313 against deletion, Operating Set-Ups No: 1, 2 and 3 are equipped with the following control parameters, the use of which is discussed in section 4.2.3.

FUNCTION	PARAMETER		VALUE		UNIT
6 Delete	1 Memory secured	:	—1	—1	
6 Delete	2 Cont. memory secured	:	—1	—1	

Measurements stored in the Last Memory of the 2313 and on the Cassette Recorder Type 7400, cannot normally be accidentally deleted using the **Delete** function as the data source has to be specified in order to execute **Delete**. Furthermore, tape recorded data can be write-protected against delete or over recording by folding back or removing the safety tabs on the rear of the tape cassette.

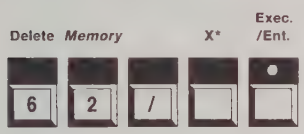
The –1 in the parameter list is the default value and indicates that the function is not activated.

Basic Pushkey Commands

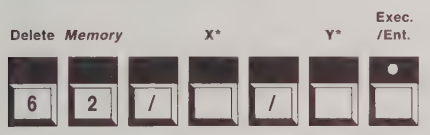
The pushkey commands used for deleting non delete-secured or write-protected measurement data, are as follows:

Deletes Last Memory

Deletes Memory file 0

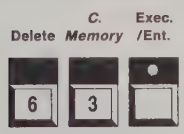


Deletes Memory file X

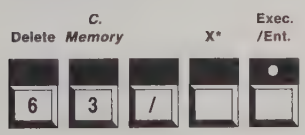


Deletes Memory file X to Y

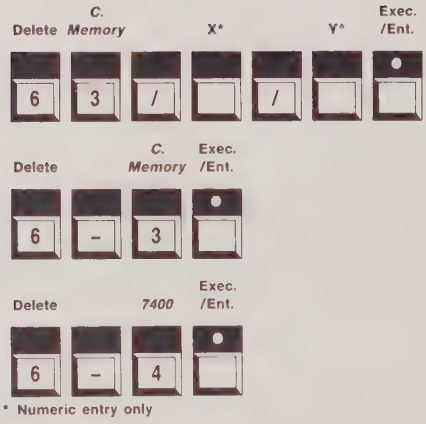
Deletes all Memory files



Deletes Cont. Memory file 0



Deletes Cont. Memory file X



Deletes Cont. Memory file X to Y .

Deletes all Cont. Memory files

Deletes all 7400 files

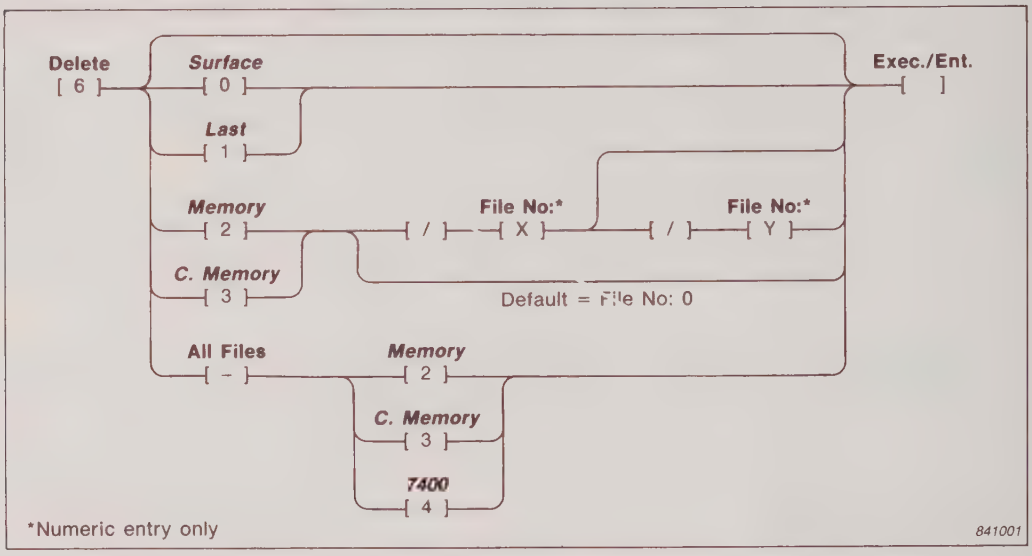


Fig. 4.12. Chart for all usable pushkey sequences beginning with **Delete**

Delete						
Function	**Para. 0**	**Para. 1**	**Para. 2**		**Destination**	**Source**
[Delete]				**[Exec.]**	Bin	Last
[Delete]	**[*Surface*]**			**[Exec.]**	Bin	Surf. memory
[Delete]	**[*Last*]**			**[Exec.]**	Bin	Last
[Delete]	**[*Memory*]**			**[Exec.]**	Bin	Memory 0
[Delete]	**[*Memory*]**	**[/][X]**		**[Exec.]**	Bin	Memory X
[Delete]	**[*Memory*]**	**[/][X]**	**[/][Y]**	**[Exec.]**	Bin	Mem.X to Y incl.
[Delete]	**[-][*Memory*]**			**[Exec.]**	Bin	All files
[Delete]	**[*Cont. Memory*]**			**[Exec.]**	Bin	C. memory 0
[Delete]	**[*Cont. Memory*]**	**[/][X]**		**[Exec.]**	Bin	C. memory X
[Delete]	**[*Cont. Memory*]**	**[/][X]**	**[/][Y]**	**[Exec.]**	Bin	C. mem.X to Y incl.
[Delete]	**[-][*Cont. Memory*]**			**[Exec.]**	Bin	All files
[Delete]	**[-][*7400*]**			**[Exec.]**	Bin	All files

Parameter interval: X: 0 – 31999
Y: 0 – 31999

Bin: "Waste paper bin", the data are irretrievable

T00455GB0

Table 4.7. All usable pushkey sequences beginning with **Delete**

4.2.8. Memory Menu [7] – Function No: 7

This function lists short-form data on the memory and tape files utilized for storing measurements. Besides specifying file number, date and time of storage, plus type of measurement stored as shown in Fig. 4.13, it prints `DS` or `SS` alongside those memory files which are delete- or store-secured or both (see sections 4.2.3 and 4.2.7). Where files not recorded with aid of the 2313 are encountered when reading in files from the 7400, `Not a 2313 file` will be printed by the Recorder.

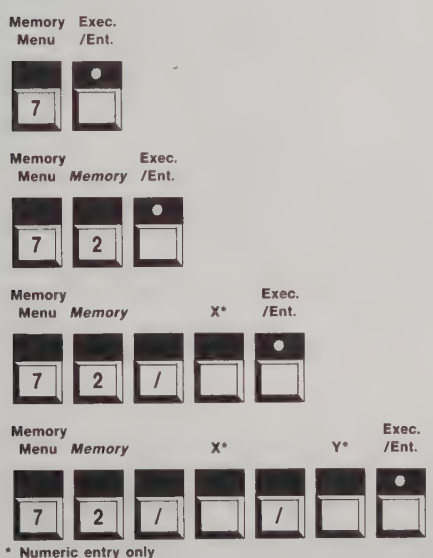
```
 MEMORY          DATE          TIME       DATA   TYPE
Last memory      1984-04-20    15:14:42   1/3    octave Intensity

CONT.  MEMORY    DATE          TIME       DATA   TYPE
   2     DS      1984-04-20    15:14:42   1/3    octave Intensity
   1     DS      1984-04-20    15:01:27   1/3    octave Pressure: Ch A
   0     SS      1984-04-20    15:16:10   1/1    octave Intensity
   8     SS      1984-04-20    15:01:27   1/3    octave Pressure: Ch A


MEMORY           DATE          TIME       DATA   TYPE
   8             1984-04-20    15:16:10   1/1    octave Intensity
   7             1984-04-20    15:16:08   1/1    octave Intensity
   6             1984-04-20    15:16:05   1/1    octave Intensity
   5             1984-04-20    15:16:03   1/1    octave Intensity
   4             1984-04-20    15:15:31   1/1    octave Intensity
   3             1984-04-20    15:15:21   1/1    octave Pressure: Ch B
   2             1984-04-20    15:14:42   1/3    octave Intensity
   1             1984-04-20    15:10:27   1/3    octave Pressure: Ch A
```

OP2313CF0

Fig. 4.13. Typical **Memory Menu** *of measurements stored with the Memory, C. Memory and Last Memory of the 2313*

Basic Pushkey Commands

The pushkey commands for listing stored data with the **Memory Menu** function are as follows:



Similarly for short–form data on C. Memory or 7400 files, press ***C. Memory*** or ***7400*** instead of the ***Memory*** pushkey.

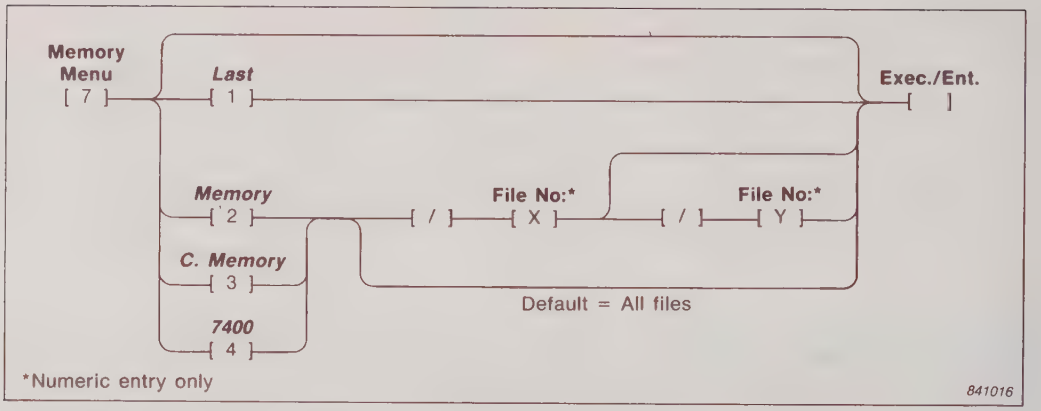


Fig. 4.14. Chart for all usable pushkey sequences beginning with **Memory Menu**

Memory Menu						
Function	**Para. 0**	**Para. 1**	**Para. 2**		**Destination**	**Source**
[Memory Menu]				[Exec.]	Printer	Last
[Memory Menu]	[*Last*]			[Exec.]	Printer	Last
[Memory Menu]	[*Memory*]			[Exec.]	Printer	All files
[Memory Menu]	[*Memory*]	[/] [X]		[Exec.]	Printer	Memory X
[Memory Menu]	[*Memory*]	[/] [X]	[/] [Y]	[Exec.]	Printer	Mem. X to Y incl.
[Memory Menu]	[*Cont. Memory*]			[Exec.]	Printer	All files
[Memory Menu]	[*Cont. Memory*]	[/] [X]		[Exec.]	Printer	C. mem. X
[Memory Menu]	[*Cont. Memory*]	[/] [X]	[/] [Y]	[Exec.]	Printer	C. mem. X to Y incl.
[Memory Menu]	[*7400*]			[Exec.]	Printer	All files
[Memory Menu]	[*7400*]	[/] [X]		[Exec.]	Printer	7400 file X
[Memory Menu]	[*7400*]	[/] [X]	[/] [Y]	[Exec.]	Printer	File X to Y incl.

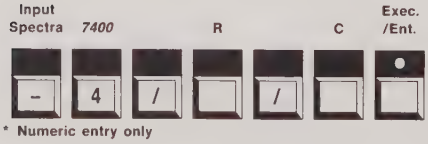
Parameter interval: X: 0 – 31999
Y: 0 – 31999

T00456GB0

Table 4.8 All usable pushkey sequences beginning with **Plot Contour**

4.2.9. Plot Contour [8] – Function No: 8

The **Plot Contour** function produces a Contour Plot or a Data Plot. For any type of mapping, the data must be located in the memory of the 2313. If the input to **Plot Contour** is measurement data placed in the Memory by the **Input Spectra** function then activating **Plot Contour** automatically produces a map file and places it in Last Memory. If the input to **Plot Contour** is data from a Cassette Recorder Type 7400, then the **Input Spectra** function must be used to transfer data from the 7400 to memory using:



Where R is the number of rows and C is the number of columns. First file no. on the 7400 is given in the Set-up.

A map file contains for each measurement point a single value which can be the measured level for a specified frequency chosen by means of the function parameters or a calculated linear or A-weighted value for a specified frequency interval determined by

means of the common set-up function 202, parameter 3. The map file is a compressed form of measurement data and can be moved from Last Memory to other storage locations for later use.

A data plot is simply a two dimensional grid of equispaced points containing the measured values (either overall or in a specified frequency band). A contour plot is a data plot plus contour lines representing lines of equal sound pressure level, sound intensity level etc. The maximum grid size for a contour plot or a data plot is 10 × 15 measurement points and the number of files which can be stored in Memory is:

302 1/1 octave measurements
or 228 1/3 octave measurements
or 123 1/12 octave or other measurements

For measurements requiring larger grid sizes, the data should be measured and recorded on the 7400 and the final plot can then be composed from smaller sections.

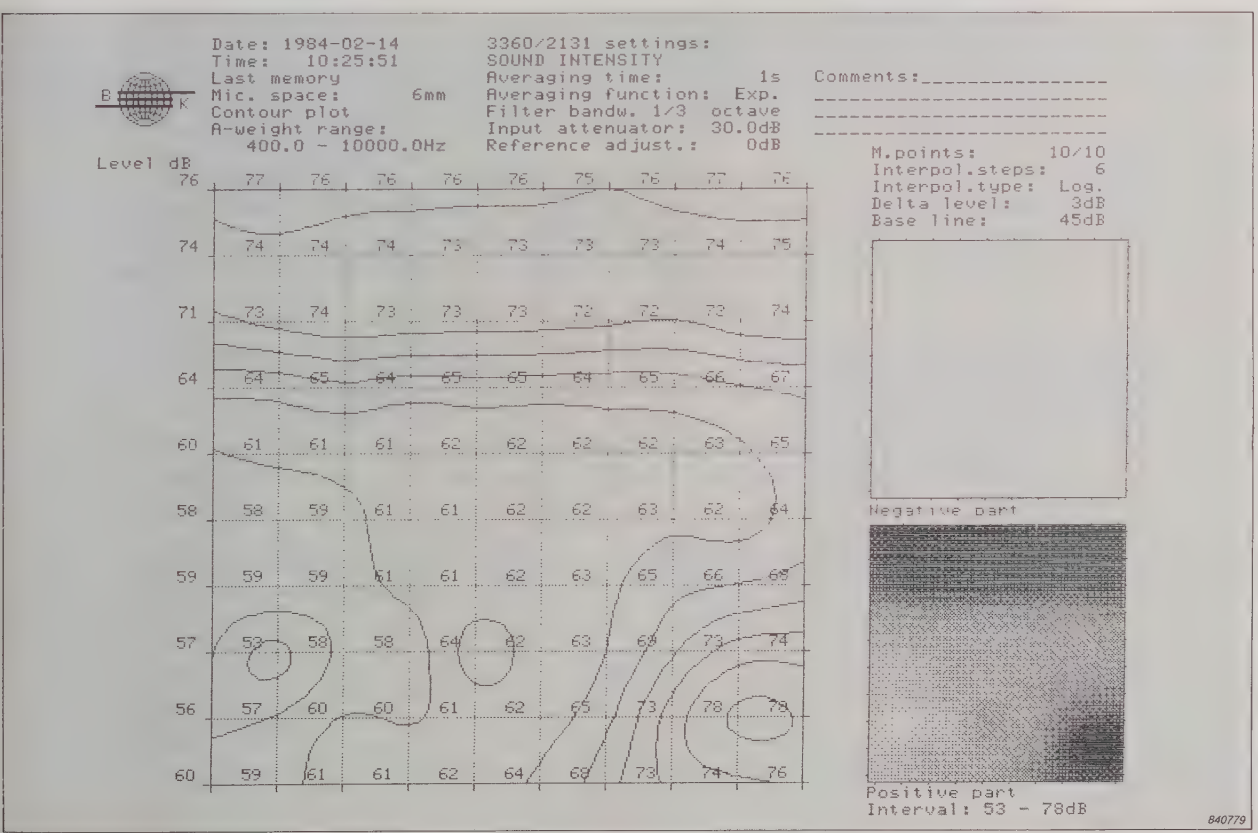
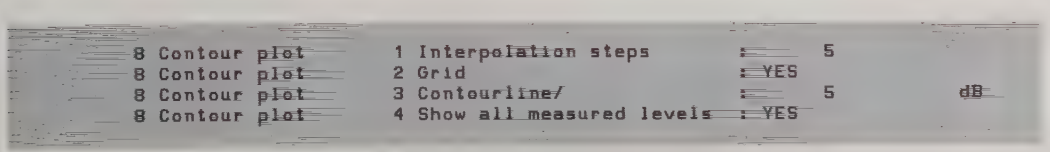


Fig. 4.15. Typical Contour Plot

Parameters

The appearance of the plot depends on the plot parameters chosen under set-up. The parameters available are:


8 Contour plot 1 Interpolation steps : 5
8 Contour plot 2 Grid : YES
8 Contour plot 3 Contourline/ : 5 dB
8 Contour plot 4 Show all measured levels : YES

1–Interpolation steps: Specifies the number of points interpolated between the measured points. If the number of interpolation steps is set to –1 the maximum permissible number of interpolation steps is selected by the 2313. The maximum number of interpolation steps is the truncated value of [90/(N–1)]–1 where N is either the number of columns or the number of rows whichever is the greater.

2–Grid: If set to **Yes**, the plot is provided with a measurement grid.

3–Contourline/: Specifies the range in dB between the contour lines, in a whole number of dBs in the interval 1 to 10.

4–Show all measured levels: If set to **Yes**, the plot is provided with the measured levels or the calculated linear or A-weighted levels at each grid point.

The parameters available in the Common Set-Up 202 are:

```
COMMON SETUP:
 202 Contour, 3D-plot   1 Interpolation      : Default
 202 Contour, 3D-plot   2 Base line          :   -1    dB
 202 Contour, 3D-plot   3 Frequency interval : 100  10000  A-weight
 202 Contour, 3D-plot   4 Mic. space         :  12    mm
```

1–Interpolation: The interpolation method may be set to linear, logarithmic or default by pressing **[.]** when the parameter is selected. If set to the default value, then linear interpolation is employed when the measured data contain both positive and negative intensity and logarithmic interpolation is employed when the measured data contain purely positive or purely negative intensity.

2–Base line: Determines the baseline level on the plot. If set to the default value of –1 then the baseline level is taken as the baseline level on the analyser.

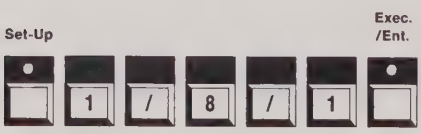
3–Frequency interval: Determines the frequency interval of interest. Pressing the **[.]** pushbutton applies either the A-weighted or linear level over the frequency range of interest.

4–Mic. space: Specifies which microphone spacing used in the probe during the measurement of the sound intensity data. If 50 mm spacing is employed then for intensity measurements the high frequency channels are set to the base line level for the following conditions:

Bandwidth	Channel	Frequency
1/1 octave	33	2000 Hz
1/3 octave	34	2500 Hz
1/12 octave	—	2722 Hz

T00666GB0

Changing set-up parameters

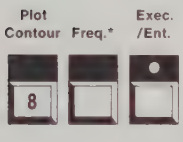


Activates Set-Up. Selects Set-Up no. 1, function no. 8, parameter no. 1.

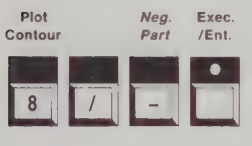
Interpolation steps set to 4. Deactivates set-up.

Activating the function

Produces a contour plot, and a map file placed in Last Memory. Levels at measurement positions are Linear or A-weighted for the frequency interval specified by parameter (202, 3).



Produces a contour plot, and a map file placed in Last Memory. Levels at measurement positions are the measured levels for the frequency band specified by **Freq**.



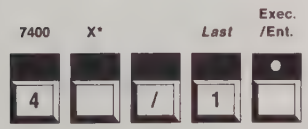
Produces a data plot, and a map file placed in Last Memory. Levels at measurement positions are Linear or A-weighted for the frequency interval specified by parameter (202, 3).

Produces a data plot, and a map file placed in Last Memory. Levels at measurement positions are the measured levels for the frequency band specified by **Freq**.

For a particular contour plot, the selected frequency is automatically updated so that pressing the **Exec./Ent.** key once more will produce a plot for the next frequency band and so forth.

If required the appearance of the plots may be altered, by changing the Set-Up parameter values for **Contour Plot** function 8 and Common Set-up functions 201, 202.

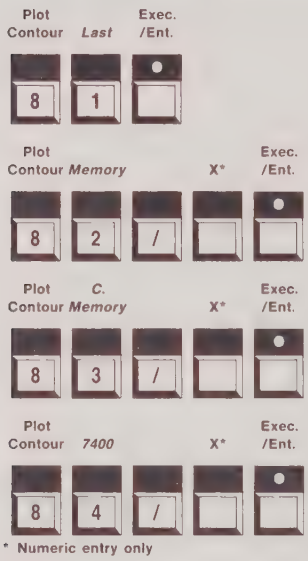
Each time a contour plot is produced, a map file is placed in the last memory. This map file may be stored in the continuous memory or on tape for later use by using the **Move Destination** function. The pushkey commands are:



Records a map file in file X on the 7400.

Records a map file in Cont. Memory X.

Plotting a map file placed in storage



Plots the map file stored in Last Memory.

Plots the map file stored in Memory X.

Plots the map file stored in Cont. Memory X.

Plots the map file stored in file X of the 7400.

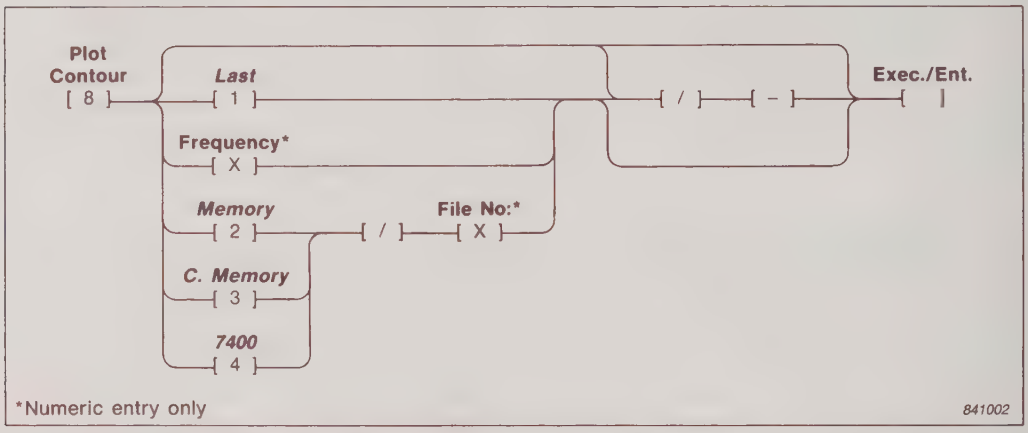


Fig. 4.16. Chart for all usable pushkey sequences beginning with **Plot Contour**

Plot Contour						
Function	**Para. 0**	**Para. 1**	**Para. 2**		**Destination**	**Source**
[Plot Contour]				**[Exec.]**	Printer	Mem 101→
[Plot Contour]		**[/][–]**		**[Exec.]**	Printer	Mem 101→
[Plot Contour]	**[freq]**			**[Exec.]**	Printer	Mem 101→
[Plot Contour]	**[freq]**	**[/][–]**		**[Exec.]**	Printer	Mem 101→
[Plot Contour]	***[Last]***			**[Exec.]**	Printer	Last
[Plot Contour]	***[Last]***	**[/][–]**		**[Exec.]**	Printer	Last
[Plot Contour]	***[Memory]***	**[/][X]**		**[Exec.]**	Printer	Memory X
[Plot Contour]	***[Memory]***	**[/][X]**	**[/][–]**	**[Exec.]**	Printer	Memory X
[Plot Contour]	***[Cont. Memory]***	**[/][X]**		**[Exec.]**	Printer	C. Memory X
[Plot Contour]	***[Cont. Memory]***	**[/][X]**	**[/][–]**	**[Exec.]**	Printer	C. Memory X
[Plot Contour]	***[7400]***	**[/][X]**		**[Exec.]**	Printer	7400 file X
[Plot Contour]	***[7400]***	**[/][X]**	**[/][–]**	**[Exec.]**	Printer	7400 file X

Parameter interval:
X: 0 – 31999
Freq: 1.6 to 22000 Hz
→: Uses all relevant subsequent files.

Remarks: When [–] is entered as shown, a plot is generated containing only the data values

T00458GB0

Table 4.9. All usable pushkey sequences beginning with **Plot Contour**

4.2.10. Plot 3D [9] – Function No: 9

The **Plot 3D** function produces a 3D plot of sound pressure and sound intensity measurements (both of negative and of positive intensity). For any type of mapping, the data must be located in the memory of the 2313. If the input to the function is data placed in the **Memory** by the **Input Spectra** function then the **Plot 3D** function also produces a map file and places it in **Last Memory.** If the input to **Plot 3D** is data from a Cassette Recorder Type 7400, then the **Input Spectra** function must be used to transfer data from the 7400 to memory using:

Where R is the number of rows and C is the number of columns. First File no. on 7400 is given in Set-Up

A map file contains for each measurement point a single value, which can be the measured level for a specified frequency or a calculated linear or A-weighted level for a frequency interval specified using function 202, parameter 3. The map file is a compressed form of the measurement data and can be moved from **Last Memory** to other storage locations for later use. The maximum grid size 10 by 15 and the maximum number of files which can be stored in **Memory** is:

302 1/1 octave files
228 1/3 octave files
123 1/12 octave files

For measurements requiring larger grid sizes, the data should be measured and recorded on the 7400 and the final plot can then be composed from smaller sections. See section 4.2.11 and 4.3.2 entitled Input Spectra and Contour, 3D-expand.

Parameters

The appearance of the plot depends on the plot parameters chosen under set-up. The parameters available are:

```
9 3D plot        1 Range          :     70        dB
9 3D plot        2 Grid           : YES
9 3D plot        3 Viewangle      :     30
9 3D plot        4 Viewcorner     :      1
```

1-Range: Specifies the range in dB for the Z-axis. 10 dB to 170 dB.

2-Grid: If Yes the plot is furnished with a grid.

3-Viewangle: Specifies the viewangle which can be from 0° to 60°.

4-Viewcorner: Specifies which corner is placed at the point of origin of the 3 axes.

The parameters available with the Common Set-Up function 202 are:

```
COMMON SETUP:
 202 Contour, 3D-plot   1 Interpolation      : Default
 202 Contour, 3D-plot   2 Base line          :    -1    dB
 202 Contour, 3D-plot   3 Frequency interval : 100  10000  A-weight
 202 Contour, 3D-plot   4 Mic. space         :   12    mm
```

1–Interpolation: The interpolation method may be set to linear, logarithmic or default by pressing **[.]** when the parameter is selected. If set to the default value, then linear interpolation is employed when the measured data contain both positive and negative intensity and logarithmic interpolation is employed when the measured data contains purely positive or purely negative intensity.

2–Base line: Determines the baseline level on the plot. If set to the default value of –1 then the baseline level is taken as the baseline level on the analyser.

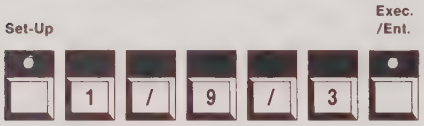
3–Frequency interval: Determines the frequency interval of interest. Pressing the **[.]** pushbutton applies either the A-weighted or linear level over the frequency range of interest.

4–Mic. space: Specifies which microphone spacing used in the probe during the measurement of the sound intensity data. If 50 mm spacing is employed then for intensity measurements the high frequency channels are set to the base line level for the following conditions:

Bandwidth	Channel	Frequency
1/1 octave	33	2000 Hz
1/3 octave	34	2500 Hz
1/12 octave	—	2722 Hz

T00668GB0

Changing set-up parameters



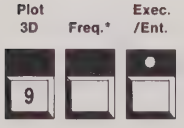
Activates set-up. Selects set-up no.1, function no.9, parameter no.3

Viewangle set to 20°

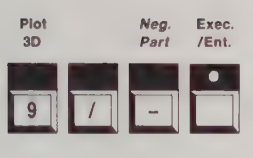
Deactivates set-up.

Activating the function

Produces a contour plot, and a map file placed in Last Memory. Levels at measurement positions are Linear or A-weighted for the frequency interval specified by parameter (202, 3).



Produces a 3D-plot, and a map file placed in Last Memory. Levels at measurement positions are the measured levels for the specified frequency band **Freq**.



Produces a 3D-plot for the negative part of the measurement, and a map file placed in Last Memory. Levels at measurement positions are Linear or A-weighted for the specified frequency interval in set-up (202, 3).

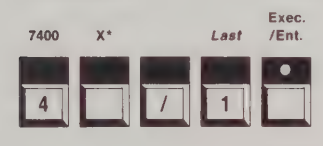
Produces a 3D-plot for the negative part of the measurement, and a map file placed in Last Memory. Levels at measurement positions are the measured levels for the specified frequency band **Freq.**

Pressing **Exec./Ent** again will produce a 3D-plot for the next frequency band, pressing **Exec./Ent** yet again produces a 3D-plot for the next frequency band and so forth.

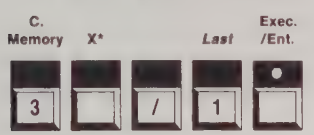
If required the appearance of the plots may be altered, by changing the Set-Up parameter values for **Plot 3D** function 9 and Common functions 201, 202.

Storage of a mapfile

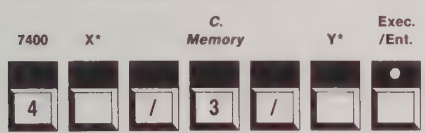
Each time a contour plot is produced, a map file is placed in the last memory. This map file may be stored in the continuous memory or on tape for later use by using the **Move Destination** function. The pushkey commands are:



Records a map file in file X on the 7400.

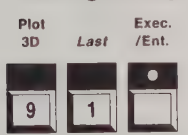


Records a map file in Cont. Memory X.

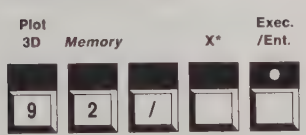


Records a map file in File X on the 7400 from Cont. Memory Y.

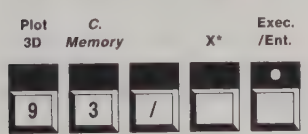
Plotting a map file placed in storage



Plots the map file stored in Last Memory.



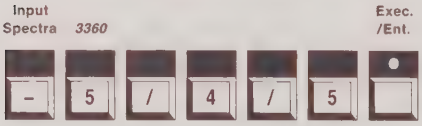
Plots the map file stored in Memory File X



Plots the map file stored in Cont. Memory File X

Plots the map file stored in file X of the 7400.

Example of measurement in 1/3 or 1/1 octaves employing Plot 3D & Plot Contour



Measures 20 spectra over a 4 × 5 grid.

Press **Read Out** on the Remote Indicating Unit ZH 0250 20 times to measure and store spectra in Memory: 101, 102, 103, 104, 105, 201, 202, 203, 204, 205, 301, 302, 303, 304, 305, 401, 402, 403, 404, 405. If **Input Spectra** function, parameter 9 is set to **Yes** then a separate linear averaging start is required which means that to start each measurement the **Averaging Start** button on the Remote Indicating Unit must first be pressed and then **Read Out** pressed to transfer the measured spectrum to the 2313.

If parameter 9 is set to **No** then one need only press **Read Out**, and if linear measurements are being performed then the analyser will be set to Exponential Averaging between the measurements.

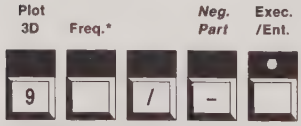
Produces a contour plot for a specified frequency interval.

Produces a 3D plot for a specified frequency interval. When dealing with intensity the positive part is printed.

Produces a 3D plot for a specified frequency interval. When dealing with intensity the negative part is printed.

Produces a contour plot for the specified frequency interval.

Produces a 3D plot for the specified frequency band. When dealing with intensity the positive part is printed.



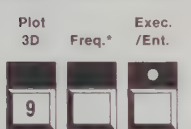
Produces a 3D plot for the specified frequency band When dealing with intensity the negative part is printed.

Example of measurement in 1/12 octaves employing Plot 3D & Plot Contour

Measures over a 2 × 3 grid in 1/12 octave.

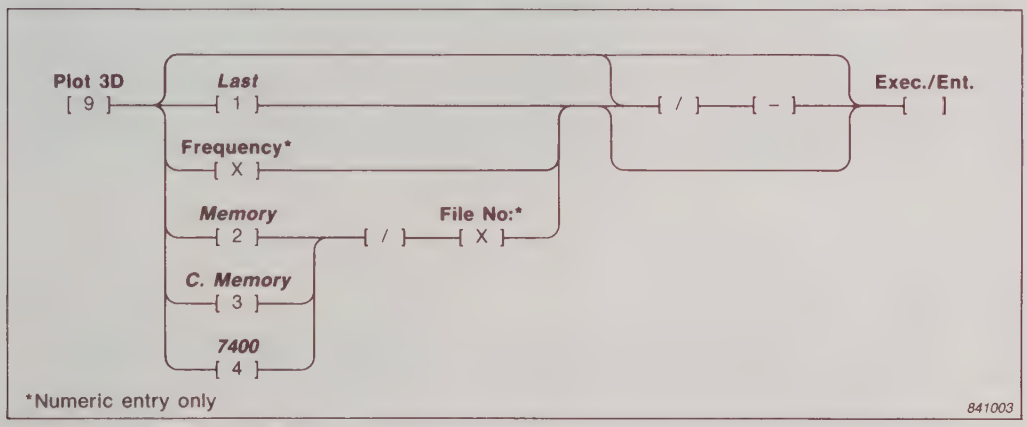
Press **Read out** on the Remote Indicating Unit ZH 0250 6 times to measure and store data in memories 101, 102, 103, 201, 202, 203. If **Input Spectra** function, parameter 9 is set to **Yes** then a separate linear averaging start is required which means that to start each measurement the **Averaging Start** button on the Remote Indicating Unit must first be pressed and then **Read Out** pressed to transfer the measured spectrum to the 2313.

Produces a contour plot for the specified 1/12 octave centre frequency.



Produces a 3D plot for the specified 1/12 octave centre frequency.

* Numeric entry only



Plot 3D						
Function	**Para. 0**	**Para. 1**	**Para. 2**		**Destination**	**Source**
[Plot 3D]				**[Exec.]**	Printer	Mem 101 →
[Plot 3D]		**[/][*Neg.Part*]**		**[Exec.]**	Printer	Mem 101 →
[Plot 3D]	**[freq]**			**[Exec.]**	Printer	Mem 101 →
[Plot 3D]	**[freq]**	**[/][*Neg.Part*]**		**[Exec.]**	Printer	Mem 101 →
[Plot 3D]	**[*Last*]**			**[Exec.]**	Printer	Last
[Plot 3D]	**[*Last*]**	**[/][*Neg.Part*]**		**[Exec.]**	Printer	Last
[Plot 3D]	**[*Memory*]**	**[/][X]**		**[Exec.]**	Printer	Memory X
[Plot 3D]	**[*Memory*]**	**[/][X]**	**[/][*Neg.Part*]**	**[Exec.]**	Printer	Memory X
[Plot 3D]	**[*Cont. Memory*]**	**[/][X]**		**[Exec.]**	Printer	C. Memory X
[Plot 3D]	**[*Cont. Memory*]**	**[/][X]**	**[/][*Neg.Part*]**	**[Exec.]**	Printer	C. Memory X
[Plot 3D]	**[*7400*]**	**[/][X]**		**[Exec.]**	Printer	7400 file X
[Plot 3D]	**[*7400*]**	**[/][X]**	**[/][*Neg.Part*]**	**[Exec.]**	Printer	7400 file X

Parameter interval:
X: 0 – 31999
Freq: 1.6 -22000 Hz
→: Uses all relevant subsequent files

T00459GB0

Table 4.10. All usable pushkey sequences beginning with **Plot 3-D**

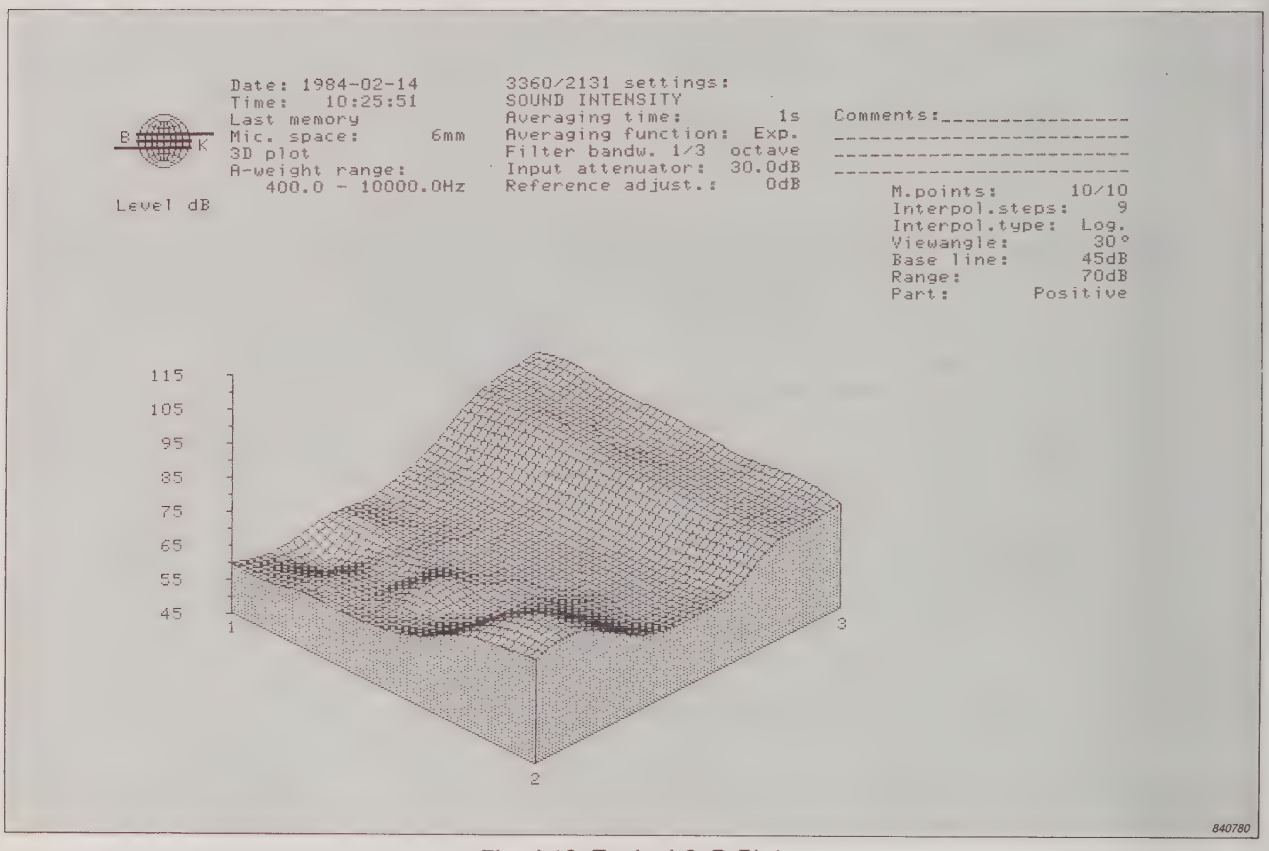


Fig. 4.18. Typical 3–D Plot

4.2.11. Input Spectra [–] – Function No: 10

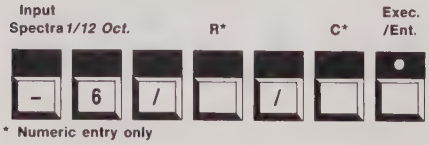
When accepting data by means of the **Input Spectra** function, the BZ 7004 distinguishes between "manual" files and "2313" files. Manual files are those which have been recorded on tape without the use of the 2313 i.e. 3360 and 7400; whilst 2313 files have been recorded on tape using the 3360 with the 2313 and the 7400.

If the **Input Spectra** function is used to store measurement files in the 2313, the file number indicates the position of the measurement in the measurement grid. A file number rrcc means that the measurement was made at row number rr and column number cc. For example, file number 203 was measured in row 2 in column 3.

When the source of the spectra is the 3360, a measurement is started by pressing:

Where R is the number of rows and C is the number of columns.

If the source is the 3360 and a 1/12 octave analysis is required then a measurement is started by pressing:



Where R is the number of rows and C is the number of columns.

* Numeric entry only

Each time **Read Out** on the Remote Indicating Unit ZH 0250 is pressed an analysis starts. If the **Input Spectra** function, parameter 9 is set to **Yes** then a separate linear averaging start is required which means that to start each measurement the **Averaging Start** button on the Remote Indicating Unit must first be pressed and then **Read Out** must be pressed to transfer the measured spectrum to the 7400 or to the 2313. This is the same measurement procedure as a manual measurement. If the analysis is in 1/12 oct., then it is performed as a 4 pass analysis. Parameter 9, **Separate linear averaging start**, has no influence on 1/12 octave analyses.

Once the **Input Spectra** function has been activated, the only control on the analyser which may be altered is the frequency range, otherwise a warning will appear on subsequent print outs stating "Different Settings". Note that if the analyser is set in the exponential averaging mode then when the remote indicating unit is employed to start a measurement involving linear averaging, the analyser setting changes before the first measurement to linear averaging. This yields a warning of "Different Settings" on the print out. To avoid this, the analyser should first be set in the linear averaging mode before employing the ZH 0250.

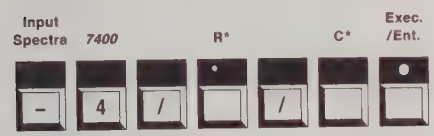
If **Help** is pressed while the function is active, the next measurement (Row, Column) to be performed is printed. It is possible to remeasure spectra using **Input Spectra** function parameter 8 (see example of a measurement of a 4 row, 5 column grid below).

The succession of the measurements is indicated in the figure below.

	4	16	17	18	19	20
Row	**3**	11	12	13	14	15
	2	6	7	8	9	10
	1	1	2	3	4	5
		1	**2**	**3**	**4**	**5**
		Column				

T00398GB0

If the spectra from a measurement are stored on a 7400 in the manual way, these files can be read into 2313 by pressing:

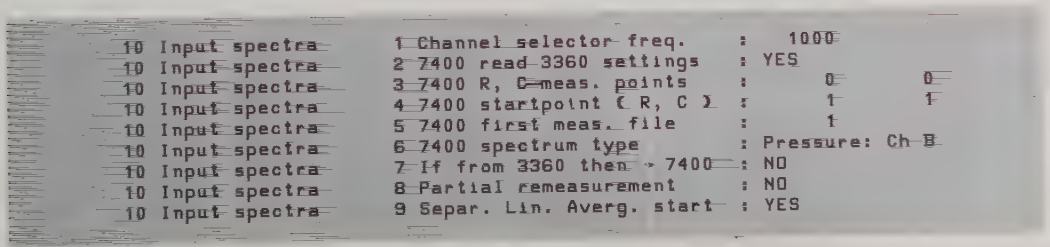


* Numeric entry only

Where R is the number of rows and C is the number of columns

It is not necessary to specify the nature of the files on the 7400 as the BZ 7004 can distinguish between manual files and 2313 files.

Parameters


10 Input spectra 1 Channel selector freq. : 1000
10 Input spectra 2 7400 read 3360 settings : YES
10 Input spectra 3 7400 R, C-meas. points : 0 0
10 Input spectra 4 7400 startpoint (R, C) : 1 1
10 Input spectra 5 7400 first meas. file : 1
10 Input spectra 6 7400 spectrum type : Pressure: Ch B
10 Input spectra 7 If from 3360 then -> 7400 : NO
10 Input spectra 8 Partial remeasurement : NO
10 Input spectra 9 Separ. Lin. Averg. start : YES

1–Channel selector freq.: Specifies at which channel the channel selector is situated. This is also the channel monitored on the Remote Indicating Unit ZH 0250.

2–7400 read 3360 settings: The source of data is the 7400 and the files are manually measured. If set to **Yes** the settings of the 3360 will be read from analyser. If set to **No** the settings will not be read and the type of the spectra is specified by parameter 6.

Parameters 3 to 5 are used to specify which part of which measurement is selected on 7400. This also enables larger grids to be measured than 10 × 15.

3–7400 R, C–meas. points: Specifies the number of rows and columns. Permissible values from 0 to 300.

4–7400 startpoint (R, C): Specifies the start point in a measured grid. Permissible values from 1 to 300.

5–7400 first meas. file: If set to 0 then the first measurement file is the currently selected file. If set to –1 then the last file on the tape is the last measured file in the measurement. If set to a value X, then X is the first file in the measurement. Permissible values from –1 to 31 999.

6–7400 spectrum type: Specifies the type of spectrum. With a normal 2131 the type of spectrum can only be "Pressure". With 3360 it can be Pressure Ch. A, Pressure Ch. B or Intensity. With a 3360 modified with WH 1493 it can be any one of the following: Autospectrum Ch. A, Autospectrum Ch. B, Cross Spectrum Real Part, Cross spectrum Imaginary Part, Surface Velocity, Surface Intensity, Pressure Ch. A, Pressure Ch. B, Intensity. One can step through the various spectrum types by repeatedly pressing **Yes [.]**.

7–If from 3360 then → 7400: If source is 3360 and the parameter is set to **Yes** the destination for the data is the 7400, otherwise it is the **Memory** of the 2313. When set to **Yes** then it is possible record on the 7400 measurement grids greater than 10 × 15, which then can be plotted out in smaller sections.

8–Partial remeasurement: If set to **Yes** the next activation of the **Input Spectra** function is for a remeasurement of some spectra.

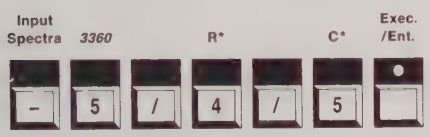
9–Separ. Lin. Averg. start: If set to **No** and the analyser is set in linear averaging, then a Linear measurement is started when **Read Out** on the Remote Indicating Unit is pressed and when the averaging is completed, the result is read out automatically by 2313. While waiting for the start of a new measurement, the analyser will be set in Exponential Averaging mode. If set to **Yes** the procedure is the same as the manual measurement with 3360 and 7400 that is first **Linear Averaging Start** must be pressed and then **Read Out** to transfer a spectrum to the 7400 or the 2313.

If **Input Spectra** is activated without specifying the number of rows and columns, the measurement will proceed as for measurement of **Sound Power**. The 2313 assumes that the sound power surface specification in the non-volatile memory is to be used. If this surface specification has been deleted by activating **[Delete] [Surface]** then activation of **Input Spectra** results in a demand for a new surface specification i.e. the number of measurement segments, the number of elements in each segment and the area of each segment. For more details on **Sound Power** see section 4.2.16.

Only 1 measurement for 3D or contour plot may be stored in the 2313 at a time. If a new measurement is started, the previous data are deleted, unless these are delete-secured or store-secured. In this case an error message is printed. Data can be stored in compressed form in **Memory**, **Cont. Memory**, or on the 7400 as a Map File. (see sections on Plot 3D and Plot Contour).

Example of measurement of a 4 row, 5 column grid

This example illustates how spectra can be measured over a specified grid size using the **Input Spectra** function. The 20 spectra of 4 row 5 column grid are stored in the **Memory** of the 2313 in positions: 101, 102 103, 104, 105, 201, 202, 203, 204, 205, 301, 302, 303, 304, 305, 401, 402, 403, 404 and 405. The **Input Spectra** function is then used replace a number of the stored spectra.



Activates measurement. The 2313 is ready to receive 20 spectra from the 3360.

Read out

Spectrum stored in memory 101.

Read out

Spectrum stored in memory 102.

Restarts measurement from row 1 column 2.

Read out

Spectrum stored in memory 102.

Read out

Spectrum stored in memory 103.

Read out

Spectrum stored in memory 104.

Read out

Spectrum stored in memory 105.

Read out

Spectrum stored in memory 200.

.
.
.
.

Read out

Spectrum stored in memory 405.

* Numeric entry only

It is possible to restart the function **Input Spectra**, and remeasure incorrect spectra by setting parameter (10, 8) "Partial remeasurement" in the Set-Up to **Yes**, and restarting the function.

Reactivates measurement.

If **Help** is pressed now it will indicate that the next measurement is Row 4, Column 5, which was the last measurement. It is now possible to return to any specified position in the measurement by entering:

Where R is the number of the row, C is the number of the column and Z is the number of remeasurements.

Activates measurement and stores the specified number of remeasurements.

After the specified number of remeasurements, pressing **Help** will cause the 2313 to indicate the last measurement of the grid, in this case Row 4, Column 5. Further remeasurements are now possible without having to reactivate the **Input Spectra** function, by keying in, as shown above, the number of the row, the number of the column of the start point for remeasurement and the number of remeasurements. When all remeasurements are completed press **Reset** to interrupt the function.

The measurements can be verified by pressing:

Prints a list of the spectra stored in **Memory**.

Remeasurement changes the order of the stored measurements, so that the last measurements are placed at the top of the list.

Example of input of part of a measurement

This example illustrates how the **Input Spectra** function can be used to take part of a set of measurements and to plot an intensity contour map. The full measurement consisted of an 8 row, 8 column grid over the top surface of a matrix printer of dimensions 0,4 × 0,4 m. The measurement grid is shown below superimposed on the printer, together with a contour plot at 4000 Hz.

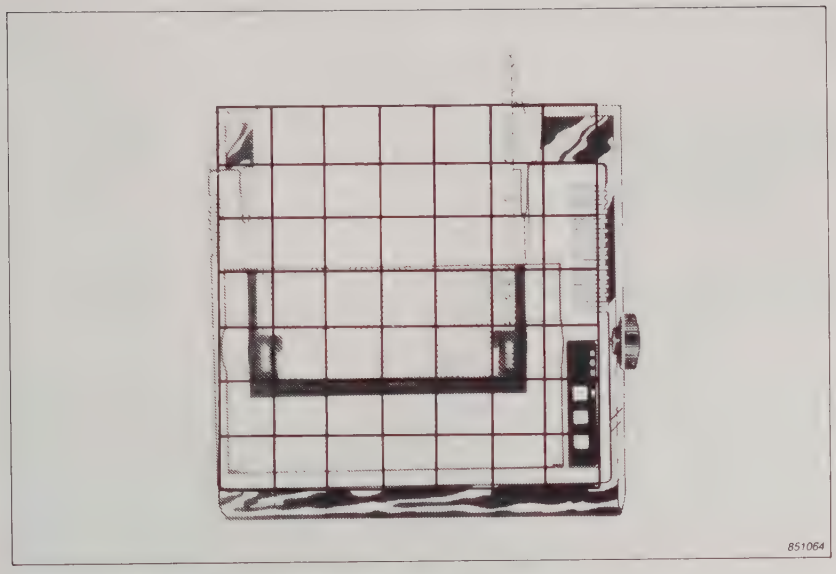


Fig. 4.19. Matrix printer with grid superimposed

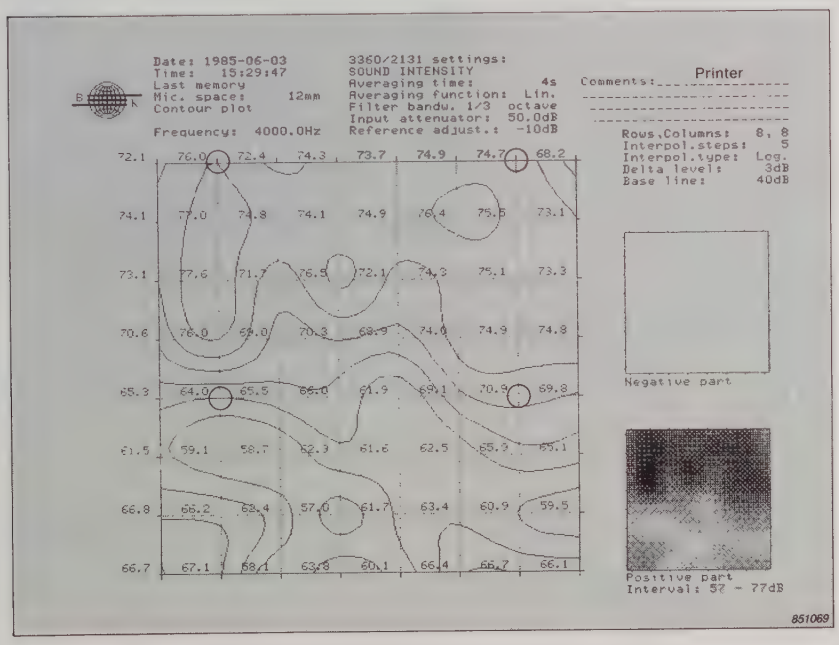
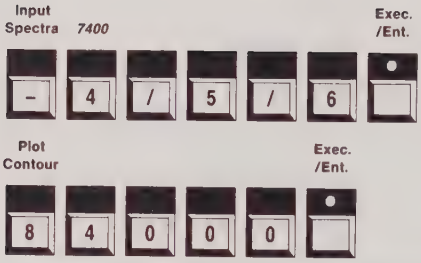


Fig. 4.20. Full contour plot, 8 rows and 9 columns

Suppose the area of interest was the region bounded by measurement points (4,2), (8,2), (8,7), (4,7), where the first co-ordinate is the row and the second the column. The measurements contained within this area can be taken from the tape and put into the **Memory** of the 2313 ready for example for contour plotting and 3D-plotting, by setting the **Input Spectra** parameters to the following values:

```
Input Spectra     3 7400 R, C-meas. points:   8   8
Input Spectra     4 7400 startpoint (R,C) :   4   2
Input Spectra     5 7400 first meas. file :   1
```

Then:



Reads in the 30 spectra of interest

Prints a contour plot for the 4000 Hz third octave band.

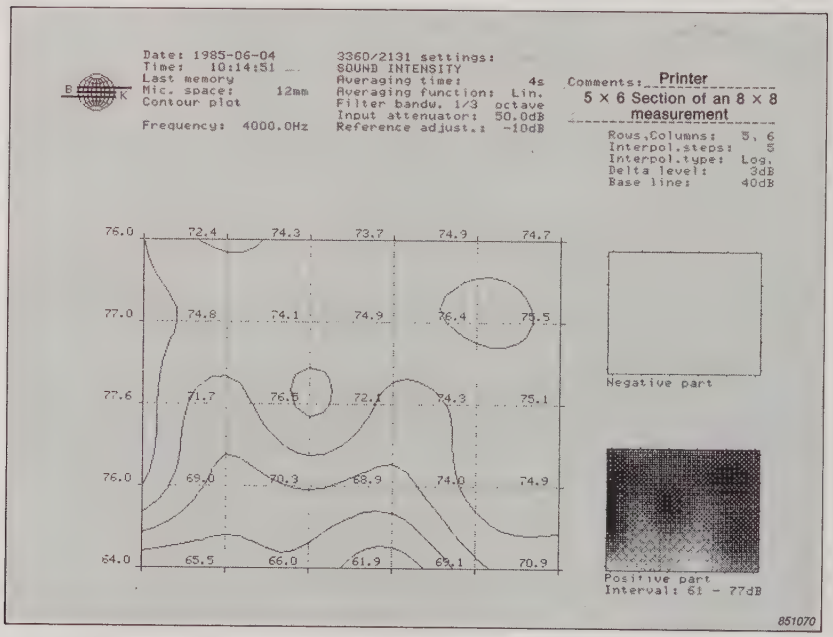


Fig. 4.21. Part of Contour plot, 5 rows and 6 columns

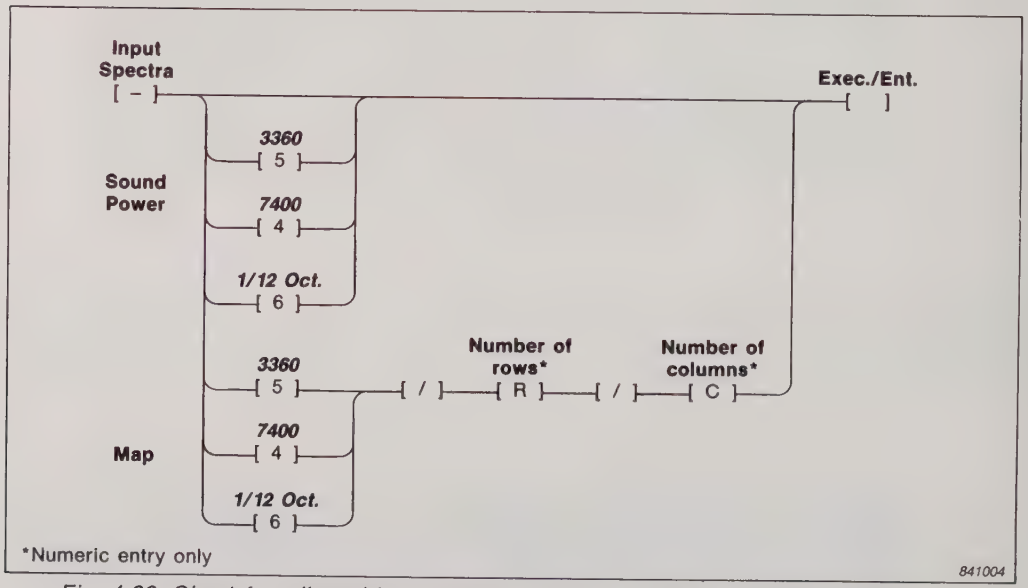


Fig. 4.22. Chart for all usable pushkey sequences beginning with **Input Spectra**

Input Spectra						
Function	**Para. 0**	**Para. 1**	**Para. 2**		**Destination**	**Source**
[Input Spectra]	**[*3360*]**	**[/][R]**	**[/][C]**	**[Exec.]**	Mem 101→	3360
[Input Spectra]	**[*3360*]**			**[Exec.]**	Mem 101→	3360
[Input Spectra]	**[*3360*]**	**[/][R]**	**[/][C]**	**[Exec.]**	7400*P	3360
[Input Spectra]	**[*3360*]**			**[Exec.]**	7400*P	3360
[Input Spectra]	**[*1/12 Oct.*]**	**[/][R]**	**[/][C]**	**[Exec.]**	Mem 101→	3360
[Input Spectra]	**[*1/12 Oct.*]**			**[Exec.]**	Mem 101→	3360
[Input Spectra]	**[*1/12 Oct.*]**	**[/][R]**	**[/][C]**	**[Exec.]**	7400*P	3360
[Input Spectra]	**[*1/12 Oct.*]**			**[Exec.]**	7400*P	3360
[Input Spectra]	**[*7400*]**	**[/][R]**	**[/][C]**	**[Exec.]**	Mem 101→	7400
[Input Spectra]	**[*7400*]**			**[Exec.]**	Mem 101→	7400

Parameter interval:
R: 0 – 10 Row number
C: 0 – 15 Column number
P: File at tape position

*Remarks: Destination is 7400 if setup function 10, parameter 7 is set to YES
→: Subsequent files

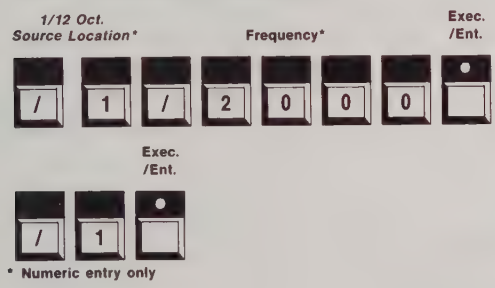
T00460GB0

Table 4.11. All usable pushkey sequences beginning with **Input Spectra**

4.2.12. 1/12 oct. Source Location [/][1] – Extended Function No: 11

This extended function is used to locate a noise source in 1/12 octave bands. The required 1/12 octave is specified and the functions accesses the digital filter coefficients in the 3360, selects the pass containing the required 1/12 octave band and moves the channel selector to this band.

Basic Pushkey Commands



Sets the cursor of the analyser to the nearest 1/12 octave band i.e. 2039 Hz.

Returns the analyser to normal 1/3 octave analysis mode. **Note** that this return is important otherwise the analyser will remain in this mode until the next Power Off/On.

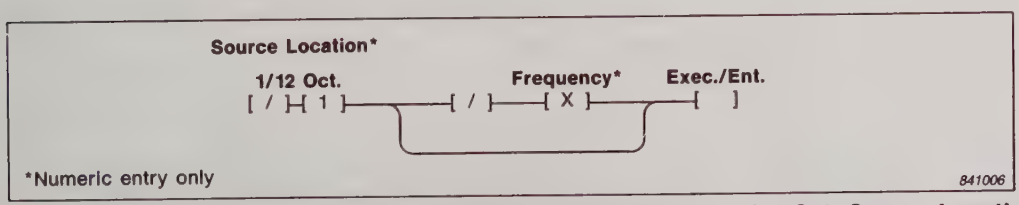


Fig. 4.23. Chart for all usable pushkey sequences beginning with **1/12 Oct. Source Location**

1/12 Oct. Source Location					
Function	**Para. 0**	**Para. 1**	**Para. 2**	**Destination**	**Source**
[Ext.] [1]	**[/] [freq]**		**[Exec.]**	3360	3360
Parameter interval: Freq:	1.6 – 22000 Hz				

T00461GB0

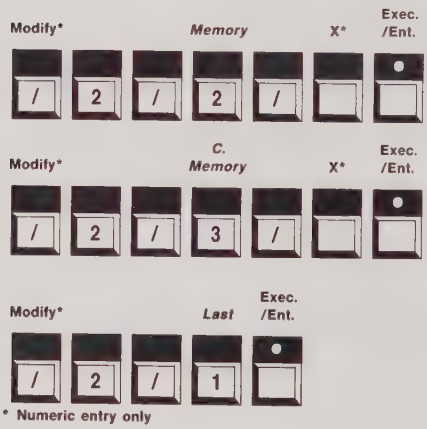
Table 4.12. All usable pushkey sequences beginning with **1/12 Oct. Source Location**

4.2.13. Modify Spectrum [/] [2] – Extended Function No: 12

This function enables the modification of 1/1, 1/3 or 1/12 octave spectra stored in **Last Memory**, **Memory** or **Cont. Memory**. The levels of the individual frequency bands of the spectra can be altered either to eliminate non essential data or to generate reference spectra for subsequent comparison with other measurements.

Basic Pushkey Commands

To modify a spectrum which has been stored in the 2313, the stored spectrum must first be displayed on the analyser. For example:



Displays the spectrum from Memory X on the analyser and enables modification.

Displays the spectrum from Continuous Memory X on the analyser and enables modification.

Displays the spectrum from the Last Memory on the analyser and enables modification.

X may have any value between 0 and 31999.

Display of 1/3 and 1/1 Octave Spectra

It is important to note that for display of 1/3 and 1/1 measurements, spectra are split into 2 overlapping frequency ranges:

	Range 1	**Range 2**
1/3 octave	1,60 Hz to 1,25 kHz	25,0 Hz to 20,0 kHz
1/1 octave	2,00 Hz to 1,00 kHz	31,5 Hz to 16,0 kHz

T00701GB0

Table 4.13. Display ranges for 1/3 and 1/1 octave measurements

These may be selected using either the **Frequency Range** keys of the 3360 or the **Modify Cursor** key of the 2313. However, whereas the **Frequency Range** keys permit alternate selection of either Range 1 or 2, the **Modify Cursor** key simply steps from Range 1 to 2 when used to step pass the final centre frequency band of Range 1. In both cases the actual range selected can be seen from the built-in lamps of the **Frequency Range** keys. Also the centre frequency and level of the individual frequency bands of the displayed spectrum can be read at the top of the display when the **Modify Cursor** key is used to step from one band to the next. It is not recommended that the **Channel Selector** keys of the analyser be used to step the cursor as this can interfere with modification of spectra.

Display of 1/12 Octave Spectra

For the display of 1/12 octave analyses, the spectra are divided into 4 parts, each comprising two overlapping frequency ranges:

	Range 1	Range 2
Part 0	1,41 to 7,51 Hz	2,81 to 15,01 Hz
Part 1	15,9 to 85,0 Hz	31,8 to 170 Hz
Part 2	180 to 962 Hz	360 to 1925 Hz
Part 3	2039 to 10894 Hz	4079 to 21792 Hz

T00366GB0

Table 4.14. Centre frequency ranges and part numbers for display of 1/12 octave spectra on the 2131 Frequency Analyzer

In this case display starts with Part 0 – Range 1 of the spectrum and is stepped to Part 0 – Range 2, Part 1 – Range 1 etc., using the **Modify Cursor** key as described above. To aid determination of the respective frequency bands it is recommended that spectra are listed before initiating display of the spectra because it is not possible to obtain a 1/12 octave centre frequency indication on the analyser. However, it is possible to obtain a correct level indication when stepping the display cursor from one frequency band to the next.

Modification Procedure

Having obtained the desired stored spectrum on the screen of the analyser, the **Modify Cursor** key of the 2313 may be used to select the particular frequency band to be modified. Momentarily pressing the key and releasing it again steps the display cursor one band to the right, whilst holding the key pressed for a slightly longer time steps the cursor one or more bands to the left.

Following selection of a frequency band, its level can be altered simply by entering the desired dB level with aid of the top two rows of pushkeys of the 2313. For example:

Entry of **[1] [0] [4] Exec./Ent.** changes the level in the selected band to 104 dB, automatically updates the display, and alters the original spectrum contained in **Memory**, **Cont. Memory** or **Last Memory** of the Recorder. At the same time the display cursor is shifted one position to the right to permit modification of the next frequency band.

Repeated activation of **Exec./Ent.** after entry of a level automatically sets the adjacent frequency bands to the same level. Entry of a level below that actually shown on the 3360 or activating **Exec./Ent.** without entering a level, automatically sets the selected

frequency band to the dB level corresponding to the base line of the displayed spectrum. The maximum level which may be entered is 300 dB, but normally is best kept within the display range of the analyser to permit subsequent documentation and comparison with other measurements.

To return to normal operation after modification is completed, press the **Reset** keys of both the 2313 and analyser. The modified spectrum is now contained in the memory position from which it was fetched, although the L and A weighted values are **not** recalculated until the spectrum is fetched from the display of the analyser and placed in the relevant memory.

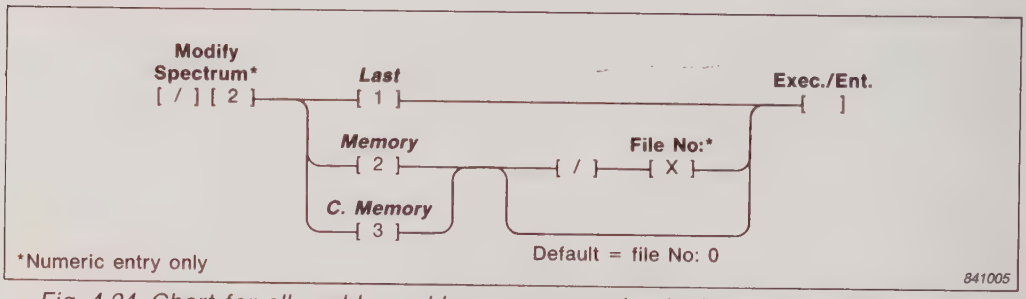


Fig. 4.24. Chart for all usable pushkey sequences beginning with **Modify Spectrum**

Modify Spectrum

Function	Para. 0	Para. 1	Para. 2		Destination	Source
[Ext.] [2]	[/] [*Last*]			[Exec.]	Last	Last
[Ext.] [2]	[/] [*Memory*]	[/] [X]		[Exec.]	Memory X	Memory X
[Ext.] [2]	[/] [*Memory*]			[Exec.]	Memory 0	Memory 0
[Ext.] [2]	[/] [*Cont. Memory*]			[Exec.]	C. Memory 0	C. Memory 0
[Ext.] [2]	[/] [*Cont. Memory*]	[/] [X]		[Exec.]	C. Memory X	C. Memory X

Hold [Modify Cursor]: ← cursor
Push [Modify Cursor]: → cursor

Parameter interval: X: 0 – 31999

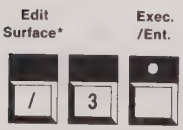
T00462GB0

Table 4.15. All usable pushkey sequences beginning with **Modify Spectrum**

4.2.14. Edit Surface [/] [3] – Extended Function No: 13

This function enables an entered surface specification to be edited. If an area for a segment is entered as a negative value, it results in change of the direction for this segment. If an area for a segment is set to zero then the segment is not included in the calculations.

Basic Pushkey Commands



Prints a list of the actual surface specification and then the format in which the new surface is to be specified using the following command.

Where X is the segment number, Y is the number of measurement points and Z is the segment area or width.

To deactivate the function press **Reset** or **Exec./Ent.**

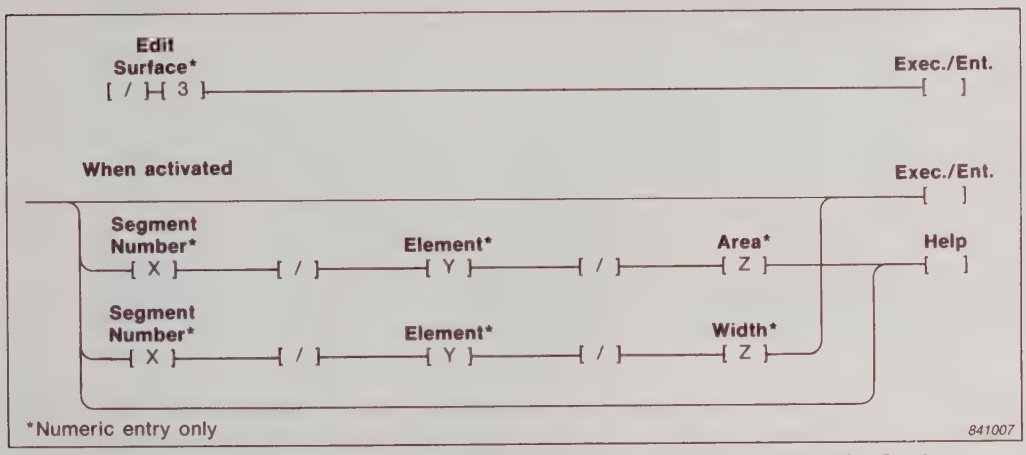


Fig. 4.25. Chart for all usable pushkey sequences beginning with **Edit Surface**

Edit Surface					
Function	**Para. 0**	**Para. 1**	**Para. 2**	**Destination**	**Source**
[Ext.] [3]			**[Exec.]**	Surf. memory	Surf. memory

T00463GB0

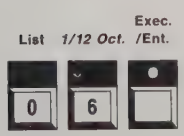
Table 4.16. All usable pushkey sequences beginning with **Edit Surface**

4.2.15. 1/12 Octave [6] – Sub Function No: 16

This is a sub function of **List, Plot, Move to Memory** etc., and remotely switches the filter coefficients of the 3360 enabling it to perform a 4-pass 1/12 octave analysis. Analysis is based on a combination of four consecutive frequency scans, each utilizing a different filter coefficient. Intermediate results of each scan are displayed on the 3360 during the course of the analysis but have to be sorted and reassembled by the 2313 to obtain a meaningful 1/12 octave frequency spectrum. The overall accuracy of the analysis is the same as that for 1/1 and 1/3 octave measurements with the 3360.

Basic Pushkey Commands

The pushkey commands for performing a 1/12 analysis, plus documenting and storing results, are as follows:



Actuates 4-pass 1/12 octave analysis plus lists results

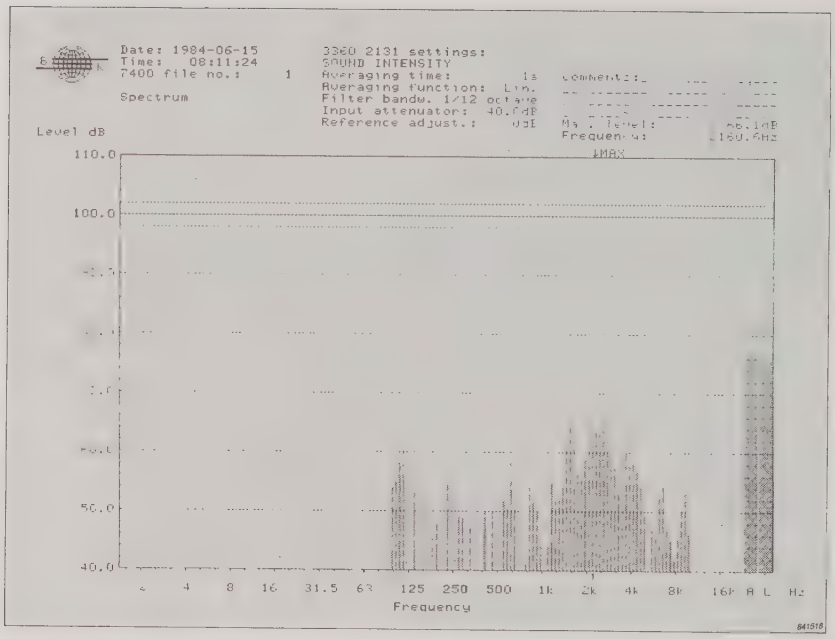
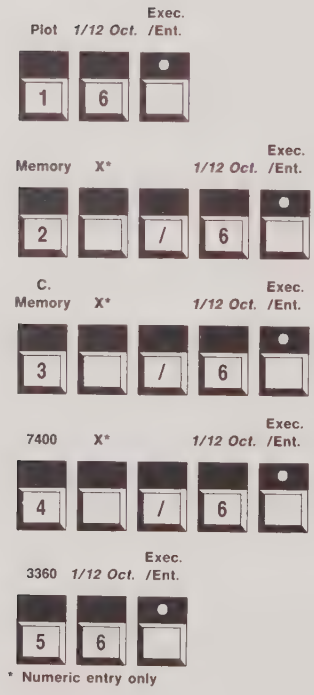


Fig. 4.26. Typical 1/12 octave plot produced by the 2313. The minimum valid frequency for the analysis is chosen using the **Set-Up** *mode and is indicated by ∧ printed just beneath the frequency scale of the plot*



Actuates 4-pass 1/12 octave analysis plus plots results

Actuates 4-pass 1/12 octave analysis storing results in Memory file X

Actuates 4-pass 1/12 octave analysis storing results in Continuous Memory file X

Actuates 4-pass 1/12 octave analysis storing results in 7400 file X

Actuates 4-pass 1/12 octave analysis plus display first part of spectrum on the 3360

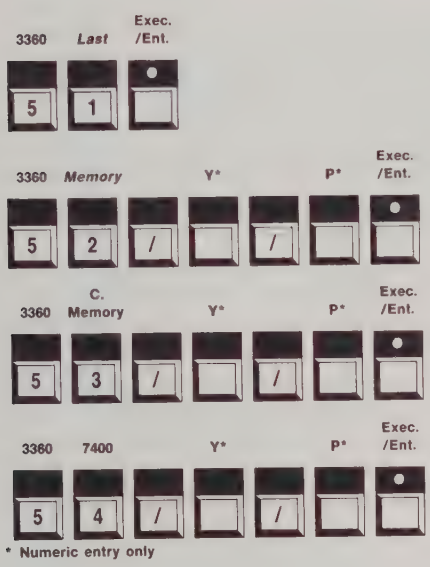
On pressing the **Exec./Ent.** key, the 2313 automatically sets the **Input Spectrum Function** of the 3360 to **"Cont."**. The analysis then proceeds either under automatic control of the 2313 or, if manual control has been chosen, waits until the **Averaging Start "Lin"** key on the 3360 is pressed to start each frequency scan in turn when directed by the 2313

ie. prints `Press <Ent>` . The type of control as well as the minimum valid frequency for the analysis is chosen with aid of the Operating Set-Up Parameters described later in this section.

After completion of the analysis, the 2313 automatically transmits the results to the particular destination requested and returns the 3360 to the control settings used before 1/12 oct. analysis was initiated. At the same time it also temporarily stores results in the Last Memory, thus enabling them to be transferred to another destination other than that orginally requested.

Display of 1/12 Octave Spectra

Besides documentation and storage, 1/12 octave analyses may be presented on the display screen of the 3360. For this purpose analyses must first be stored in a memory or tape file, and then transferred to the 3360 using one of the following commands:



Displays Part 0 of stored measurement from Last Memory

Displays Part P of stored measurement from Memory file Y

Displays Part P of stored measurement from C. Memory file Y

Displays Part P of stored measurement from 7400 tape file Y

As it is not possible to display all frequency bands of a 1/12 octave spectrum simultaneously, it is divided into four parts. Each part covers 42 consecutive frequency bands and is further subdivided into two overlapping ranges of 32 bands, as specified in Table 4.17.

Where no Part No: is entered for display of a stored spectrum, Part 0 – Range 2 is automatically chosen. To step between Range 2 and 1, press the **"1,6 – 1,25 kHz" Frequency Range** key on the 3360. Similarly, to step from Part 0 to Part 1 etc., press the **Exec./Ent.** key of the 2313.

Any attempt to step beyond Part 3 of a spectrum from a Memory or Continuous Memory file or 7400 file will automatically set the 2313 to standby plus print `File not found` . To return the 3360 to normal operating status, press its **Input Spectrum Function "Cont"** key.

1/12 Octave Band Centre Frequencies												
Hz		Hz		Hz		Hz	
1,41	2*	15,9	2*	180	2*	2039	2*
1,49		16,9		191		2161	
1,58		17,9		202		2289	
1,67		18,9		214		2425	
1,77	R	20,0	R	227	R	2570	R
1,88	a	21,2	a	240	a	2722	a
1,99	n	22,5	n	255	n	2884	n
2,11	g	23,8	g	270	g	3056	g
2,23	e	25,3	e	286	e	3238	e
2,36		26,8		303		3430	
2,50	1	28,4	1	321	1	3634	1
2,65		30,0		340		3850	
2,81	14*	31,8	14*	360	14*	4079	14*
2,98		33,7		382		4322	
3,16		35,7		404		4579	
3,34		37,9		429		4852	
3,54		40,1		454		5140	
3,75		42,5		481		5446	
3,98		45,0		510		5770	
4,21		47,7		540		6113	
4,46		50,5		572		6477	
4,73		53,5		606		6862	
5,01	R	56,7	R	642	R	7270	R
5,31	a	60,1	a	680	a	7702	a
5,62	n	63,7	n	721	n	8160	n
5,96	g	67,5	g	764	g	8646	g
6,31	e	71,5	e	809	e	9160	e
6,69		75,72		857		9705	
7,09	2	80,22	2	908	2	10282	2
1 7,51	31*	85,0	31*	962	31*	10894	31*
2 7,95		90,0		1019		11542	
3 8,43		95,4		1080		12228	
6 8,93		101		1144		12956	
5 9,46		107		1212		13726	
6 10,0		113		1285		14543	
7 10,6		120		1361		15408	
8 11,2		127		1442		16324	
9 11,9		135		1528		17295	
0 12,6		143		1619		18324	
1 13,4		151		1715		19414	
2 14,2		160		1817		20569	
3 15,0	43*	170	43*	1925	43*	21792	43*
Part 0		**Part 1**		**Part 2**		**Part 3**	

* Corresponding 2131 channel number

T00777GB0

Table 4.17. Part numbers, frequency ranges, filter centre frequencies and 1/3 octave channel numbers for display of 1/12 octave measurements on the analyser. Note that the frequencies given here are exact. In 1/12 octave listings frequencies between 10 Hz and 99 Hz are given to one decimal place. Frequencies between 100 Hz and 22000 Hz are given to the nearest Hertz.

Parameters

```
SELECTED SETUP NO.: 0
   FUNCTION              PARAMETER                          VALUE      UNIT
16 1/12 octave      1 Man. scan                      : NO
16 1/12 octave      2 Valid low freq. in auto.       :      80          Hz
```

1–Man. scan: Accepts logic **Yes** or **No** for selection of manual or automatic scanning respectively, with **No** as default.

2–Valid low freq: Accepts values between 1 and 640 Hz, with 80 Hz as default. Determines minimum frequency band sorted by the 2313 for analysis with manual and automatic scanning. The higher frequency, the shorter the measurement time (640 Hz ~ 30 s. 80 Hz ~ 35 s. 10 Hz ~ 1 min. 2 Hz ~ 3 min. 1 Hz ~ 6 min.).

4.2.16. Sound Power [7] – Sub Function No: 17

Sound Power is a sub function to the main functions **List**, **Plot** and **Move to 3360**. The function determines sound power based on sound pressure measurements in a semi-anechoic room according to ISO 3745 and ANSI S1.35. The function is also intended for use with the 3360 to determine sound power based on sound intensity measurements.

Parameters

The parameters available for the **Sound Power** subfunction are:

```
17 Sound power    1 Surface                  : General
17 Sound power    2 Number of segments       :       1
17 Sound power    3 Frequency interval       :     100     10000 Hz
17 Sound power    4 Radius                   :  1.0000E+00     m
17 Sound power    5 Print current results    : NO
```

1–Surface: Specifies whether the surface is to be described as a Hemisphere or a General surface. The pushkey **[.]** switches the setting between Hemisphere and General.

2–Number of segments: Specifies the number of segments into which the test surface is to be divided. Acceptable values from 1 to 90.

3–Frequency interval: Specifies the frequency interval over which the sound power is to be calculated. The full range is from 1 Hz to 22 000 Hz

4–Radius: Specifies the radius of the measurement hemisphere in metres. Acceptable values from 0.01 to 100 m. If General surface is selected then the setting Radius is ignored.

5–Print current results: When set to **Yes** this parameter causes the partial sound powers for the individual segments to be printed every time **List**, **Plot or Move to 3360** and ***Sound Power*** is activated.

A necessary input for ***Sound Power*** is a surface specification which is placed in a continuous memeory and is kept until deliberately deleted. If no surface specification is present in the continuous memory then the 2313 will ask for one either after the activation of **Input Spectra** or ***Sound Power.***

Basic Pushkey Commands

Measurements for sound power determination

Input to the **Sound Power** sub function is a series of spectra obtained either directly by employing the function **Input Spectra**, or by recalling spectra from the 7400. The 3 possible methods for recording the spectra are:

1. 3360 + 7400. The spectra are recorded “manually” and the files on the 7400 are described as 3360 files.

2. 3360 + 2313. The 2313 controls the documentation of the spectra and the stored files are described as 2313 memory files.

3. 3360 + 7400 + 2313. The 2313 controls the documentation of the spectra and the stored files are described as 7400-2313 files. The BZ 7004 package can recognise files which are manually recorded or which are recorded using **Input Spectra** and ***Sound Power***.

Method 1

The first method is described thoroughly in the Instruction Manual for the 3360.

Method 2. Example of sound power measurement using a hemispherical surface

The **Input Spectra** function may be used for the measurement without having to specify a grid size.

Deletes the previous surface specification stored in a continuous memory in the 2313.

Selects set-up no. 1, ***Sound Power*** function no. 17, surface parameter no. 1.

Pressing this pushkey changes the surface parameter from General to Hemisphere to General etc. Select Hemisphere.

Selects number of segments parameter no. 2.

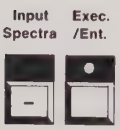
Sets the number of segments to 4.

Selects frequency interval parameter no. 3.

Sets the frequency interval to 400-10000 Hz.

Deactivates the set-up.

The controls of the analyser should now be set e.g. attenuator settings, measurement mode set to sound intensity or sound pressure.

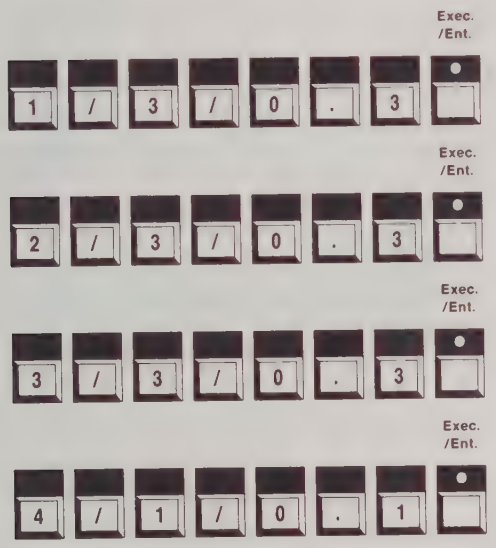


Starts the measurement and prints out a demand for the surface specifications as shown below.

```
Enter Segment no. / measure points / width [m]

SOUND POWER SURFACE SPECIFICATION
   Surface     :  Hemisphere
   Segments    :   4
   Total Area  :  6.28E+00m²
   Radius      :  1.00E+00m²
```

To calculate a sound power a surface specification must first be entered into the 2313.

The demand for a specification is printed out together with a demand for the number of measurement points per segment and the **width** of the segment. This information is entered as follows:



Segment 1, 3 points, width 0,3 m

Segment 2, 3 points, width 0,3 m

Segment 3, 3 points, width 0,3 m

Segment 4, 1 point, width 0,1 m

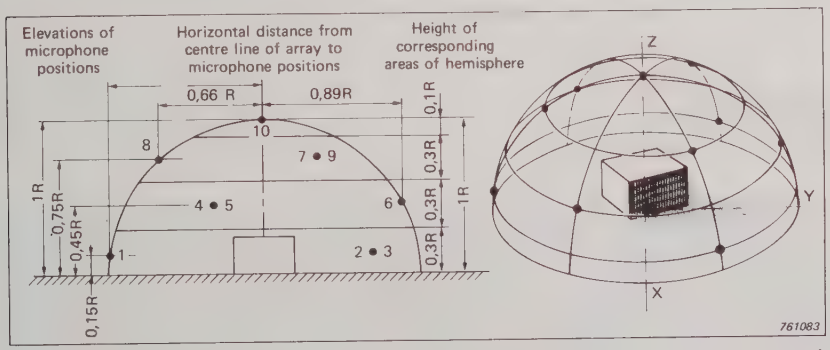
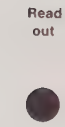


Fig. 4.27. Hemispherical test surface employing 10 measurement points

If a segment width is specified as 0 this segment will not be included in the calculation.

If **Help** is pressed during the entering, a list of the entered data is printed. After entering the data for the last segment and pressing **Exec./Ent.,** the entered data are printed out, the **Listen** lamp lights and the 2313 is ready to receive the specified number of spectra from the analyser. Spectra may be measured and read out simply by pressing **Read out**

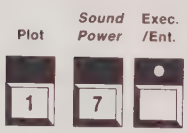
on the Remote Control Unit ZH0250 provided that Parameter number 9 "Separate averaging start" in the **Input Spectra** function is set to **No**. If set to **Yes** then the linear averaging is started by means of the **Averaging Start** button on the Remote Control Indicating Unit and after averaging pressing **Read Out** sends the spectrum to the 2313.



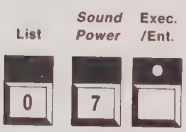
Initiates a measurement at the first element position in the first segment and stores the resulting spectrum in Memory File 101.

Initiates a measurement at the last element position in the last segment and stores the resulting spectrum in Memory File 401. The measurement is now terminated and the **Active** lamp lights.

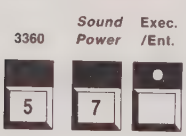
If **Help** is pressed during the measurement, the last measured element and segment number is printed out.



Plots the resultant sound power.



Lists the resultant sound power.

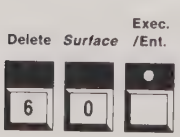


Displays the resultant sound power.

If parameter number 5-Print current results is set to **Yes** a listing of the partial sound power levels for the individual segments is printed, before final readout using the **Plot**, **List** and **3360** functions.

Method 3. Example of sound power measurement using a general surface

If the number of measurement points is so large that the data cannot be stored in the **Memory** of the 2313 then the data can be stored directly on the Cassette Recorder Type 7400 by setting the **Input Surface** function no.10, parameter no. 7 "If from 3360 then → 7400" to **Yes**.



Deletes the previous surface specification stored in a continuous memory in the 2313.

Set-Up

Selects Set-Up 1, Function no. 17, parameter no. 1.

Pressing this pushkey changes the parameter from General to Hemisphere to General etc. Select General.

Exec. /Ent.

Selects number of segments parameter no. 2.

Exec. /Ent.

Sets the number of segments to 3.

Exec. /Ent.

Selects frequency interval parameter no. 3.

Exec. /Ent.

Sets the frequency interval to 400 – 10000 Hz.

Set-Up

Deactivates the set-up.

The controls of the analyser should now be set e.g. attenuator settings, measurement mode set to sound intensity or sound pressure.

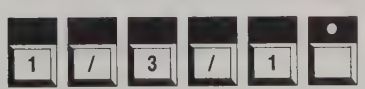
Input Spectra Exec. /Ent.

Starts the measurement and prints out a demand for the surface specification as shown below:

```
Enter Segment no. / measure points / Segm. area [m²]

SOUND POWER SURFACE SPECIFICATION
    Surface      : General
    Segments     : 3
    Total Area   : 0.00E+00m²
```

The demand for a specification is printed out together with a demand for the number of measurement points per segment and the **area** of each segment. This information is entered as follows:

Exec. /Ent.



Segment 1, 3 points, area of segment 1 m^2

Segment 2, 3 points, area of segment 1 m^2

Segment 3, 3 points, area of segment 1 m^2

If the area for a segment in a General measurement is specified as negative, it has the same effect as turning the probe 180 degrees. If a segment area is specified as 0 this segment will not be included in the calculation.

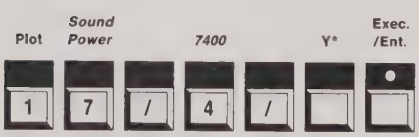
If **Input Spectra** has been used to measure over a grid, and one wishes to calculate the sound power over this surface, then the surface for the sound power calculation may be specified as 1 segment with a number of elements equal to the product of the rows and the columns, and an area corresponding to the grid area.

If **Help** is pressed during the entering, a list of the entered data is printed. After entering the data for the last segment and pressing **Exec./Ent.**, the entered data are printed out, the **Listen** lamp lights and the 2313 is ready to receive the specified number of spectra from the analyser. Spectra may be measured and read out simply by pressing **Read out** on the Remote Control Indicating Unit ZH 0250 provided that Parameter number 9 "Separate averaging start" in the **Input Spectra** function is set to **No**. If set to **Yes** then the linear averaging is started by means of the **Averaging Start** button on the Remote Indicating Unit and after averaging pressing **Read Out** sends the spectrum to the 2313.

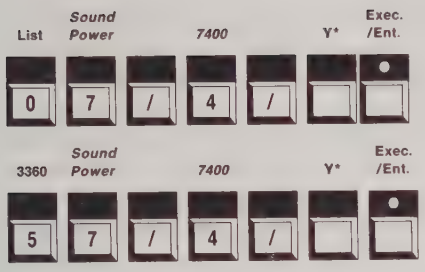
Initiates a measurement at the first element position in the first segment and stores the resulting spectrum on the 7400.

Initiates a measurement at the last element position in the last segment and stores the resulting spectrum on the 7400. The measurement is now terminated and the **Active** lamp lights.

If **Help** is pressed during the measurement, the last measured element and segment number is printed out.



Plots the resultant sound power.



Lists the resultant sound power.

Displays the resultant sound power.

Y specifies the first file. If Y = –1 then the last file on the tape is taken as the last file of the measurement.

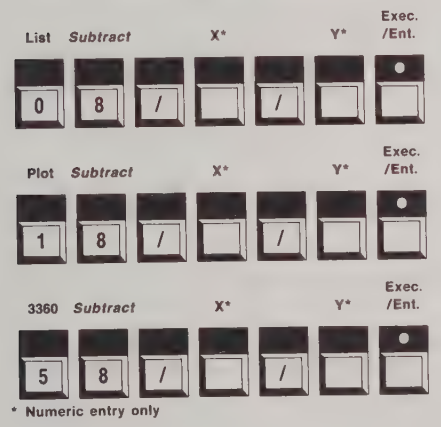
If parameter number 5, "Print current results" is set to **Yes** a listing of the partial sound power levels for the individual segments is printed, before final readout using the **Plot**, **List** and **3360** functions.

4.2.17. Subtract Spectra [8] – Sub Function No: 18

This sub function enables two spectra from **Memory** to be subtracted from each other either logarithmically or arithmetically. The resultant spectrum may be listed, plotted or displayed on the screen of the analyser.

The subfunction can subtract a pressure spectrum from a pressure spectrum, an intensity spectrum from an intensity spectrum and an intensity spectrum from a pressure spectrum.

Basic Pushkey Commands



Lists the difference between Memory File X and Memory File Y.

Plots the difference between Memory File X and Memory File Y.

Displays the difference between Memory File X and Memory File Y on the analyser's screen.

Note that it is not possible to subtract a pressure spectrum from an intensity spectrum. This command will result in an error message:

```
File of invalid data type                    ERROR NO: 104
```

Parameters

```
18 Subtract spectra   1 Arithmetical          : NO
```

1-Arithmetical: When set to **No** the difference calculation is based on logarithmic values. When set to **Yes** the difference calculation is based on arithmetic values.

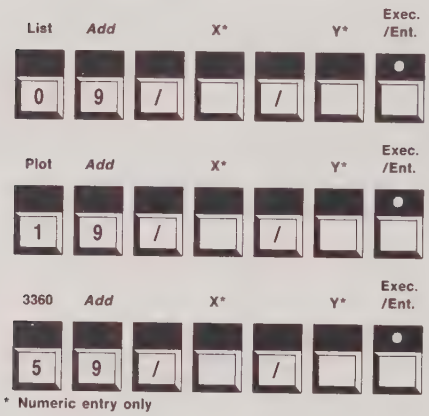
After display on the 3360 or in **List** or **Plot** form, the result is in **Last** memory and can be moved to **Memory, Continuous Memory** or 7400 for later use.

Addition and subtraction of measurement are performed by adding or subtracting, either the equivalent RMS amplitude (i.e. *antilog$_{10}$ dB level/10*) or the dB level of corresponding frequency bands. This depends on the parameters set in the current Operating Set-Up (see overleaf). Where levels below the particular display range used for recording measurements are concerned, they are set to the level corresponding with the base line of the displayed measurement.

4.2.18. Add spectra [9] – Sub Function No: 19

This sub function enables two spectra from **Memory** to be added to each other either logarithmically or arithmetically. The resultant spectrum may be listed, plotted or displayed on the screen of the analyser. The subfunction can add together two pressure spectra or two intensity spectra or an intensity spectrum plus a pressure spectrum. However the sign indicating direction intensity spectrum is not taken into account.

Basic Pushkey Commands



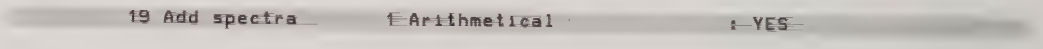
* Numeric entry only

Lists the sum between Memory X and Memory Y.

Plots the sum between Memory X and Memory Y.

Displays the sum between Memory X and Memory Y on the analyser's screen.

Parameters



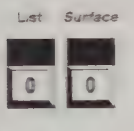
1-Arithmetical: When set to **No** the difference calculation is based on logarithmic values. When set to **Yes** the difference calculation is based on arithmetic values.

After display on the 3360 or in **List** or **Plot** for m, the result is in **Last** memory and can be moved to **Memory, Continuous Memory** or 7400 for later use.

Addition and subtraction of measurement are performed by adding or subtracting, either the equivalent RMS amplitude (i.e. *antilog$_{10}$ dB level/10*) or the dB level of corresponding frequency bands. This depends on the parameters set in the current Operating Set-Up (see overleaf). Where levels below the particular display range used for recording measurements are concerned, they are set to the level corresponding with the base line of the displayed measurement.

4.2.19. Surface [0] – Sub Function No: 20

This sub function enables surface specifications used for sound power calculations placed in a continuous memory in the 2313 to be listed or deleted. For examples of its use, see section 4.2.16 entitled Sound Power.



Lists the present surface specification.

Deletes the present surface specification.

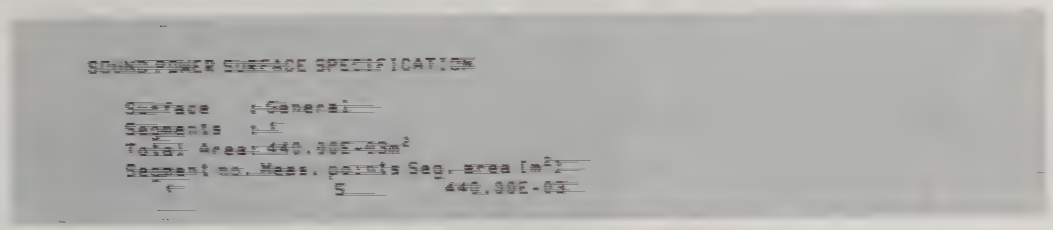


Fig. 4.28. Typical surface specification

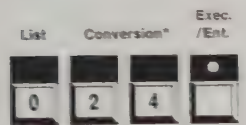
4.2.20. 7400 File to BZ 7004 File [24] – Function No: 24

Utilizing this sub function, conversion of 7400 tape files containing measurements recorded directly from the analyser is possible. This enables field recorded measurements which have not been previously processed by the 2313 to be documented and stored with the instrument.

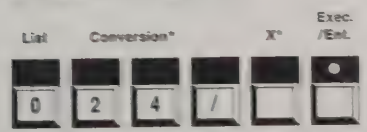
As measurements recorded directly from the analyser include no information on the analyser control settings, these must be noted by hand at the time of measurement. This is important as on playback of such a measurement, the analyser must be set to these settings to permit correct conversion by the 2313. This means that it is not possible to convert a 7400 file without including an analyser in the set-up. However once a measurement has been converted and rerecorded using the 7400, the 7400 and 2313 can be used alone.

Basic Pushkey Commands

The basic pushkey sequences for use of the ***7400 File to BZ 7004*** sub function are illustrated below.



Converts and lists measurement in currently selected 7400 file



Converts and lists analyser measurement stored in 7400 file X

Converts and plots measurement in currently selected 7400 file

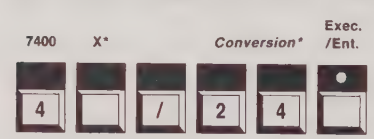
Converts and plots analyser measurement stored in 7400 file X

Converts and stores analyser measurement in Memory file X from currently selected 7400 file

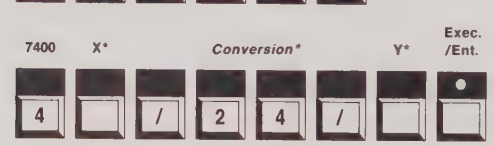
Converts and stores analyser measurement in Memory file X from 7400 file Y

Converts and stores analyser measurement in Cont. Memory file X from currently selected tape file

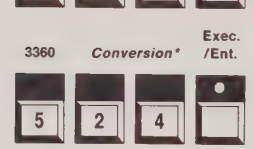
Converts and stores analyser measurement in Cont. Memory file X from 7400 file Y



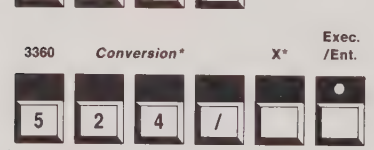
Converts and stores analyser measurement 7400 file X from currently selected 7400 file



Converts and stores analyser measurement in 7400 file X from 7400 file Y



Converts and displays measurement on the 3360 from currently selected 7400 file



Converts and displays measurement on the 3360 from 7400 file X

* Numeric entry only

Where a list and plot is generated, the converted measurement is placed in the **Last Memory**. Consequently it may be transferred to a **Memory** or **Cont. Memory** for further reference or processing at a later date.

4.2.21. Multi Subtract [/] [18] – Extended Function No: 28
Multi Add [/] [19] – Extended Function No: 29

These functions add or subtract a single 1/1, 1/3 or 1/12 octave spectrum from a series of stored measurements. The measurements must be of the same type and have been stored in consecutive **Memory** files of the 2313. Also they must be free from overload and have preferably been recorded using the same control settings on the analyser.

Practical uses of the **Multi Subtract** and **Multi Add** functions are in elimination of unwanted background noise from measurements, plus pseudo frequency weighting and integration of measurements.

Basic Pushkey Commands:
The basic pushkey commands for use of the **Multi Subtract** and **Multi Add** functions, are as follows:

Subtracts measurement in **Memory** file Z from files X to Y

Adds measurement in **Memory** file Z to files X to Y

* Numeric entry only

If one or more of the stored measurements are overloaded then summation will be interrupted and an `Overloaded channel in spectrum` message printed. Similarly, a `Different control settings` warning will be included in the list or plot, where different analyser control settings have been employed for recording the measurements. The use of different **Input Attenuator** settings, however, is permissible without influencing the accuracy of results.

Addition and subtraction of measurements are performed by adding or subtracting, either the equivalent RMS amplitude (i.e. *antilog$_{10}$ dB level/10*) or the dB level of corresponding frequency bands. This depends on the parameters set in the current Operating Set-Up (see overleaf). Where levels below the particular display range used for recording measurements are concerned, they are set to the level corresponding with the base line of the displayed measurement. When intensity spectra are included in one of these commands, only the magnitudes of the intensity spectra are employed in the calculation. No account is taken of the sign which indicates direction in an intensity spectrum.

Parameters

FUNCTION	PARAMETER	VALUE	UNIT
SUBFUNCTIONS:			
18 Subtract spectra	1 Arithmetical	: NO	
19 Add spectra	1 Arithmetical	: YES	

1–Arithmetical: Can be set to **Yes** for summation in arithmetic form (this is also the default value), or **No** for summation in dB form. Adds or subtracts the equivalent RMS level of the signal amplitudes within corresponding frequency bands, whilst that in dB form operates directly in dB.

4.2.22. Personal Text [/] [100] – Extended Function No: 110

The **Personal Text** function enables up to 20 characters of text to be entered or edited via the front panel into one or more of the text lines. There are 5 text lines which, if activated in the current Operating Set-Up, appear in the documentation heading of all lists or plots generated by the 2313. The inserted text is stored in the continuous memory.

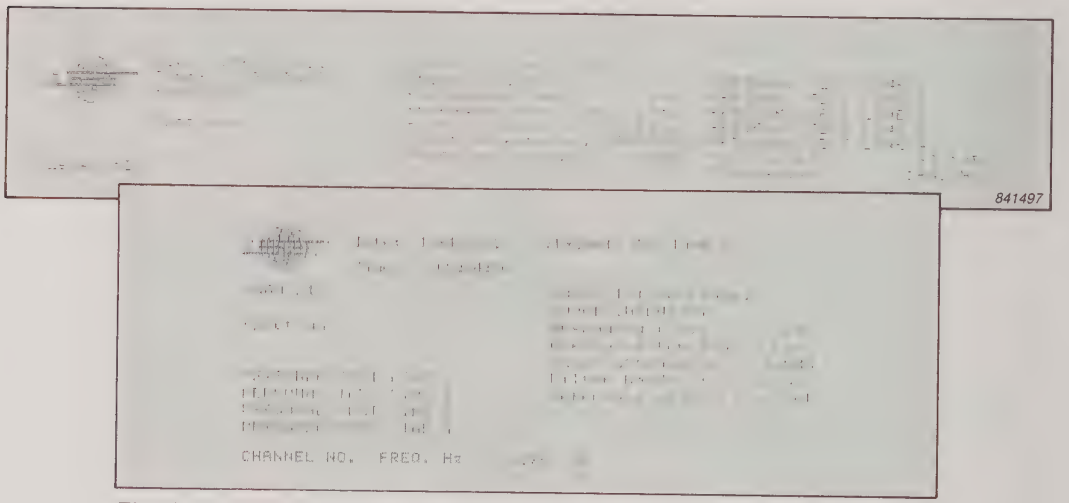


Fig. 4.29. Location of Personal text lines 0, 1, 2, 3 and 4 in the documentation heading of Lists and Plots generated by the 2313

Parameters

The parameters available with the **Personal Text** function are shown below and are for the default case. Note that the parameters are used for enabling or disabling the text. Entering personal text is discribed later.

```
        SELECTED SETUP NO.: 0
           FUNCTION                PARAMETER                    VALUE      UNIT
        SUBFUNCTIONS:
(/100) 110 Personal text      1 Enable line 0          : NO
(/100) 110 Personal text      2 Enable line 1          : NO
(/100) 110 Personal text      3 Enable line 2          : NO
(/100) 110 Personal text      4 Enable line 3          : NO
(/100) 110 Personal text      5 Enable line 4          : NO
```

By selecting **110 Personal Text**, the individual text lines can be enabled or disabled by pressing the **Yes** or **No** pushkey respectively when entering the VALUE in the Set-Up procedure. Note that even if enabled, these text lines will only appear on the **List** readout if its **"Including heading"** control parameter is enabled.

Entering Personal Text

Text can be entered and edited in the 5 text lines from 3 sources; over the IEC/IEEE interface (covered in section 6.6.13), over the Serial Interface (covered in section 7.1.2), or via the 2313 front panel.

Text is entered via the front panel by first selecting either the "Number" or "Character" mode.

Character Mode

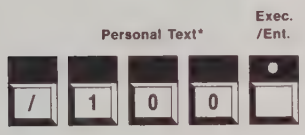
In the "Character" mode, the decimal equivalent of the ISO character is entered, separated by a **[/]** key push. The characters available with their decimal equivalents are given in the table below. Note that numbers can also be entered in the character mode by entering their decimal equivalent.

No.	Char.	No.	Char.	No.	Char.	No.	Char.	No.	Char.	No.	Char.	No.	Char.	No.	Char.
0	Δ	16	π	32	SP	48	0	64	@	80	P	96	`	112	p
1	α	17	∫	33	!	49	1	65	A	81	Q	97	a	113	q
2	^{2}	18	æ	34	"	50	2	66	B	82	R	98	b	114	r
3	Σ	19	σ	35	#	51	3	67	C	83	S	99	c	115	s
4	δ	20	τ	36	$	52	4	68	D	84	T	100	d	116	t
5	ϵ	21	ü	37	%	53	5	69	E	85	U	101	e	117	u
6	φ	22	√	38	&	54	6	70	F	86	V	102	f	118	v
7	ω	23	–	39	'	55	7	71	G	87	W	103	g	119	w
8	Ω	24	↑	40	(	56	8	72	H	88	X	104	h	120	x
9	^{0}	25	↓	41	)	57	9	73	I	89	Y	105	i	121	y
10	$_0$	26	→	42	*	58	:	74	J	90	Z	106	j	122	z
11	Ø	27	←	43	+	59	;	75	K	91	[	107	k	123	{
12	λ	28	¯	44	,	60	<	76	L	92	\	108	l	124	|
13	μ	29	_	45	–	61	=	77	M	93	]	109	m	125	}
14	±	30	|	46	.	62	>	78	N	94	^	110	n	126	~
15	■	31	|	47	/	63	?	79	O	95	_	111	o	127	DEL

T00169GB0

Table 4.18. List of personal text characters available with numbers used when writing the characters in the "Character" mode

The pushkey commands for accessing the "Character" mode are as follows:

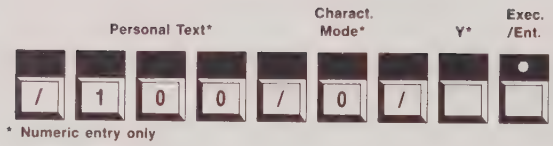


Selects Personal Text "Character" mode – text line 0

Pushkey Label	Effect
Help	Print selected text line
Exec./Ent.	Stop
/	Move to next character position
Clear Entry	Clear selected text line and return to first character position
0 to 127	Write (or overwrite) character according to Table 4.4
–	Delete character and move to next character position
.	Return to first character position
E	Move to previous character position

T00304GB0

Table 4.19. Commands when operating in Personal Text "Character" mode



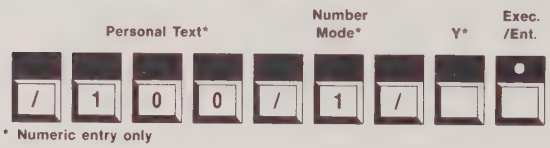
Selects Personal Text "Character" mode – text line Y where 0≤Y≤4

Once the "Character" mode has been selected using one of the above pushkey sequences, the text in the selected text line can be inserted or edited by using the key commands listed in Table 4.19.

Number Mode

In the "Number" mode, the numbers '**0**' to '**9**', '**E**' and '**.**', as printed on the pushkeys, are entered directly. The pushkey commands for accessing the "Number" mode are as follows:

Selects Personal Text "Number" mode – text line 0



Selects Personal Text "Number" mode – text line Y where 0≤Y≤4

Once the "Number" mode has been selected using one of the above pushkey sequences, the text in the selected text line can be inserted or edited by using the key commands listed in Table 4.20.

Pushkey Label	Effect
Help	Print selected text line
Exec./Ent.	Stop
/	Move to next character position
Clear Entry	Clear selected text line and return to first character position
0 to 9, –, . , E	Write (or overwrite) with number

T00305GB0

Table 4.20. Commands when operating in the Personal Text "Number" mode

4.2.23. Execute 7400 Program – Extended Function No: 111

Not applicable.

4.2.24. Store 7400 Program – Extended Function No: 112

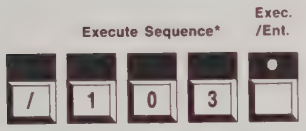
Not applicable.

4.2.25. Execute Sequence [/] [103] – Extended Function No: 113

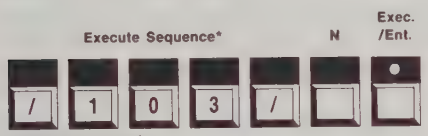
Execute Sequence executes a key push sequence, previously entered and stored in the continuous memory using the **Enter Sequence** function. If the sequence contains one or more illegal or non existent functions and parameters, it will be terminated and an appropriate error message printed. It is not possible to activate the sequence via the IEC Interface of the 2313 or store it using an external medium such as the 7400.

Basic Pushkey Command

The pushkey commands for executing a stored pushkey sequence are as follows:



Executes once, a key push sequence stored in the 2313



Executes "N" times, a stored key push sequence, where $0 \leqslant N \leqslant 32000$

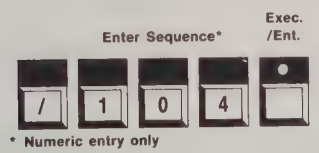
An example showing the use of **Execute Sequence**, is given in section 4.2.26.

4.2.26. Enter Sequence [/] [104] – Extended Function No: 114

The **Enter Sequence** function enables the user to enter and store in a continuous memory a pushkey sequence containing up to 100 key pushes. This allows an automatic control sequence to be developed which can be executed using the **Execute Sequence** function described in section 4.2.25. All key pushes are saved in the continuous memory, except **Reset** which ends entry of a sequence. If required the sequence can be edited using the **Edit Sequence** function described in section 4.2.27. Entry of a pushkey sequence via the IEC Interface of the 2313 is not possible.

Basic Pushkey Command

The pushkey command for entering a pushkey sequence is as follows:



Subsequent key pushes are saved by the 2313 until **Reset** is pressed

An error message "No space for file in Cont. Memory" will be printed if the Cont. Memory is filled up with various files and surface specifications. In this case some of the Cont. Memory must be deleted or moved to other storage media.

Example of a pushkey sequence used for error calculations

The 2313 can be used to calculate random errors and errors due to phase-mismatch in intensity measurements made with the Intensity Analysing System Type 3360.

Random error

Random errors can be calculated from the "reactivity index" of the measurements L_K i.e. the difference in dB between the intensity level L_I and the pressure level L_p (see Fig.4.30).

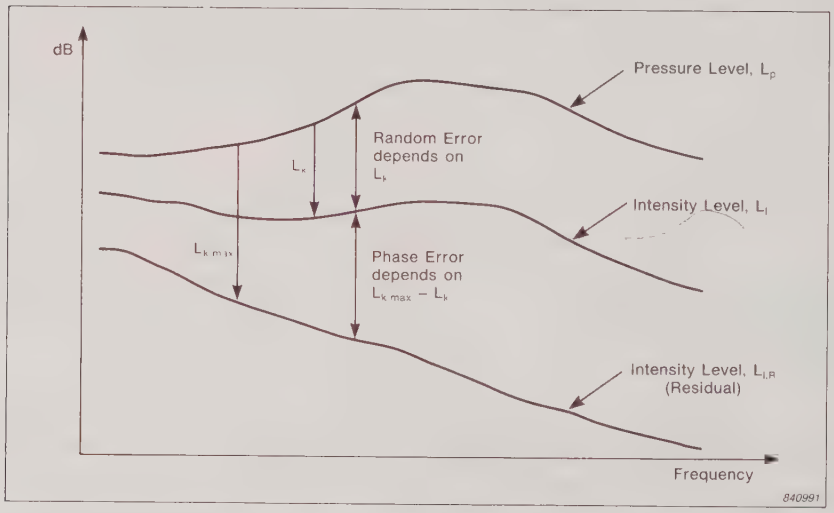
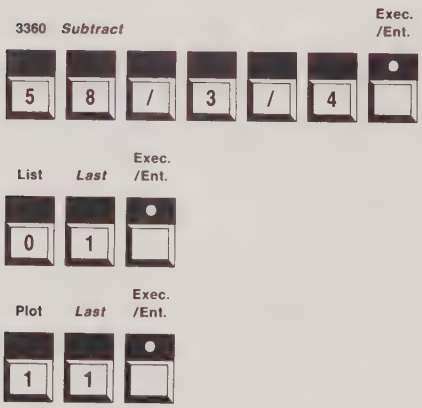


Fig. 4.30. Relationship between pressure level, intensity level and residual intensity level

The subfunction ***Subtract Spectra*** can be used to calculate this difference. If the pressure level spectrum is stored in Memory 3 and the intensity spectrum is stored in Memory 4 then the "reactivity index" can be calculated, listed and plotted by using the following commands:



Displays on the analyser the logarithmic difference between the spectra stored in Memories 3 and 4.

Lists the last measurement

Plots the last measurement

Error due to phase mismatch

Error due to phase mismatch can be calculated from the following formula:

$$L_{\epsilon_p} = 10 \log \left[10^{(-L_{K,max})/10} \pm 10^{(-L_K)/10} \right] - (-L_{K,max})$$

where $L_{K,max}$ is the difference between the intensity level (residual intensity) and the pressure level L_p when the same signal is fed into both channels of the 3360 simultaneously. In practice this can be done by exposing the intensity probe of the 3360 to a simulated diffuse field such as the field which exists inside an acoustic coupler when the

coupler is supplied with broad band noise. An ideal system would measure an average intensity of $0\,W/m^2$ in a diffuse field which on a dB scale yields an infinitely large, negative dB value. In practical intensity analysing systems however there will always be a certain amount of residual intensity due to the inevitable phase-mismatch in the system. It is this residual intensity which is measured and stored in Memory 2. The reference pressure level is stored in Memory 1.

Before the errors due to phase mismatch can be calculated by a pushkey sequence, 4 spectra must be measured and stored in Memory positions 1 to 4.

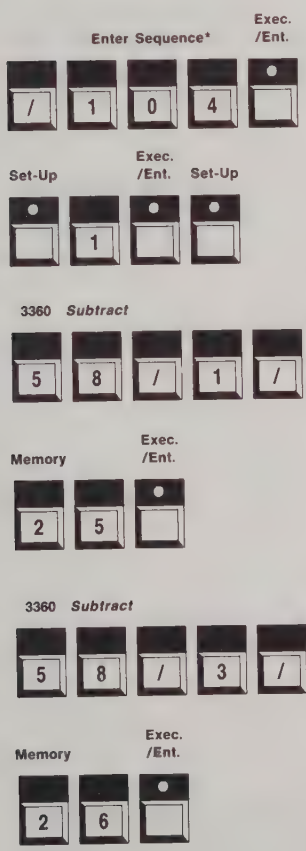
Memory 1: contains the pressure level measured in the coupler.
Memory 2: contains the intensity level measured in the coupler.
Memory 3: contains the pressure level measured around the test object.
Memory 4: contains the intensity level measured around the test object.

In Set-up 1 the following 2 parameters should be set to the default values:

```
18 Subtract Spectra: Arithmetical: NO
19 Add Spectra:      Arithmetical: YES
```

In Set-up 2 both these parameters should be set to YES.

The pushkey sequence can now be entered as follows:



Subsequent key pushes are saved by the 2313 until **Reset** is pressed

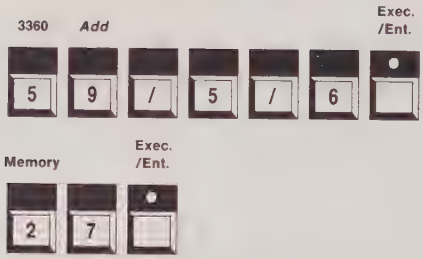
Selects and activates setup 1.

Displays on the analyser the logarithmic difference between the spectra stored in Memories 1 and 2.

Stores the resulting spectrum in Memory 5. This spectrum expresses the "dynamic capability" of the system.

Displays on the analyser the logarithmic difference between the spectra stored in Memories 3 and 4.

Stores the resulting spectrum in Memory 6. This spectrum expresses the "reactivity index" of the measurement conditions.



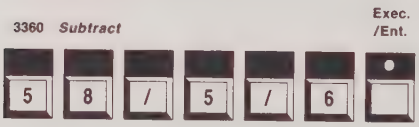
Displays on the analyser the arithmetic sum of the spectra stored in Memories 5 and 6.

Stores the resulting spectrum in Memory 7. This spectrum is the (signal + noise) in the measurement.

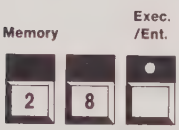
Displays on the analyser the logarithmic difference between the spectra stored in Memories 7 and 5.

Prints a list of the result. This is the positive error in the intensity level.

Selects and activates setup 2.

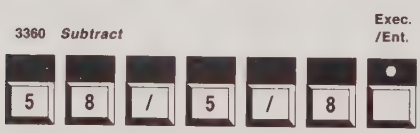


Displays on the analyser the arithmetic difference of the spectra stored in Memories 5 and 6.

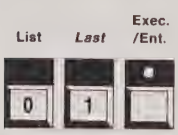


Stores the resulting spectrum in Memory 8. This spectrum is the (signal – noise) in the measurement.

Selects and activates setup 1.



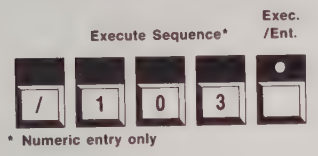
Displays on the analyser the logarithmic difference between the spectra stored in Memories 5 and 8.



Prints a list of the result which is the negative error in the intensity level.

Accepts and stores the entered sequence.

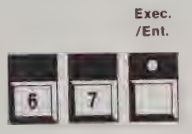
To execute the sequence press



The first and the second list will show any over-estimation and under-estimation respectively due to phase mismatch.

These calculations can only be performed if intensity levels are lower than the corresponding pressure levels. If this is not the case then the extended function **Modify Spectrum** must be employed to change the errant intensity level. To illustrate this, assume that one frequency band in the intensity spectrum stored in Memory 2 has a higher level than that of the pressure spectrum stored in Memory 1. The spectrum to be modified i.e. Memory 2 is put on the screen of the 3360 by pressing:

The **Modify Cursor** key is then used to select the frequency band of interest. Momemtarily pressing the key and releasing it again steps the display cursor one band to the right while holding the key pressed down steps the cursor one or more bands to the left. The desired level is keyed for example:



Enters a level of 67 dB.

To return to normal operation press **Reset**.

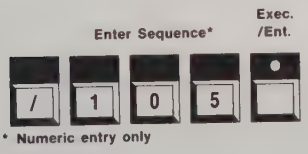
For further information about the theory behind this procedure consult B&K Application Note "Sound power determination in highly reactive environments".

4.2.27. Edit Sequence [/] [105] – Extended Function No: 115

This function enables editing of a pushkey sequence, whereby individual key pushes can be changed, inserted or deleted. The sequence is entered and stored in the continuous memory using the **Enter Sequence** function in section 4.2.26.

Basic Pushkey Command

The pushkey command for editing a pushkey sequence is as follows:



Enables stored sequence to be edited according to table 4.20 until **Exec./Ent.** is pressed to stop editing.

Pushkey Label	Effect
Help	List sequence
〈0 to max.〉 〈Exec./Ent.〉	Select keypush line number
/ 〈Keypush〉	Insert 〈Keypush〉 in selected line number
–	Delete keypush
.	Select next keypush line
E	Select previous keypush line
Exec./Ent.	Stop

T00311GB0

Table 4.21. Commands when operating in the **Edit Sequence** *Mode*

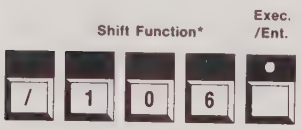
4.2.28. Shift Function [/] [106] – Extended Function No: 116

As discussed at the start of section 4.2 and in subsequent sections, the **Exec./Ent** key may be used to repeat execution of certain functions plus automatically update their parameters. For carrying out the same operation with a stored key push sequence, however, a separate function termed **Shift** must be employed. This is intended for direct inclusion in a key push sequence stored with the **Enter Sequence** function and serves to fetch a function plus increment its parameter each time the sequence is executed.

Besides allowing information to be stored in or recalled from successive memory or tape files, the **Shift** function enables a stored key push sequence to be used for a number of separate tasks simply by entering a new function prior to executing the sequence. It is, however, only possible to fetch a single function at a time, the parameter of which is to be incremented.

Basic Pushkey Command

The pushkey command for executing the **Shift** function is as follows:

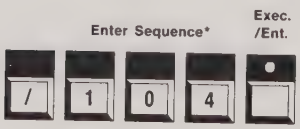


Retrieves a function, plus increments its parameter

Example of use

A method of saving individual spectra in successive **Memory** and 7400 files is given below to illustrate the usefulness of the **Shift** function.

1. Entry and storage of key push sequence for retrieving and incrementing the function initiated in item 2 below.

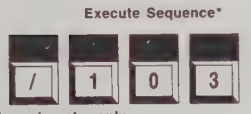


Initiates **Enter Sequence** function for entry and storage of the following key push sequence

Enters **Shift** command, to fetch and increment the function defined in item 2.

Commands execution of function defined in item 2

Command to retrieve last measurement result and store it in the correct 7400 file

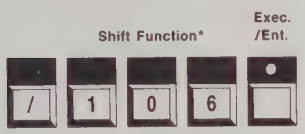


* Numeric entry only

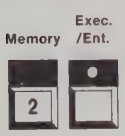
Enters command to repeat the above key push sequence

Terminates **Enter Sequence** function, storing the above key push sequence

2. Entry of function to be incremented:

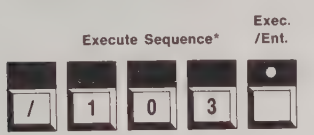


Initiates **Shift** function, for retrieving and incrementing the following function



Stores spectrum in Memory file 0

3. Execution of stored sequence and incremented function:



Executes stored key push sequence, storing spectrum in Memory file 1 and 7400 file 1

Stores new spectrum in Memory file 2 and 7400 file 2

etc.

Stores new spectrum in Memory file "n+1" and 7400 file "n+1"

* Numeric entry only

Note: Pressing the **Reset** key either just before or during execution of a stored key push sequence, will delete the function to be incremented. In order to re-execute the sequence afresh, one must repeat entry of the function to be incremented, i.e. repeat items 2 and 3.

4.2.29. Wait [/] [107] – Extended Function No: 117

When a time is entered and this function is executed as part of a 100-step key push sequence, the 2313 waits until the actual clock time is an exact multiple of the inserted time in seconds before continuing with the sequence.

Example 1: If 1 hour is inserted as the wait time and the clock is at 8:45:15 the 2313 will wait until 9:00:00 (i.e. 1 hour × 9) before executing the sequence. If the sequence is repeated it will be re-executed at 10:00:00 (i.e. 1 h × 10), 11:00:00 (i.e. 1 h × 11), etc.

Example 2: If 18 minutes is inserted as the wait time and the clock is at 00:59:10 the 2313 will wait until 01:12:00 (i.e. 18 minutes × 4) before executing the sequence. If the sequence is repeated it will be re-executed at 01:30:00 (i.e. 18 min. × 5), 01:48:00 (i.e. 18 min. × 6), etc.

Example 3: If 1 minute 40 seconds (i.e. 100 s) is inserted as the wait time and the clock is at 10:40:20 the 2313 will wait until 10:41:40 (i.e. 100 s × 385) before executing the sequence. If the sequence is repeated it will be re-executed at 10:43:20 (i.e. 100 s × 386), 10:45:00 (i.e. 100 s × 387), etc.

Utilising **Wait** in a key push sequence, allows time for a function to be completed before continuing to the next step. In addition, it ensures functions are initiated at regular time intervals independent of the time it takes to execute the function.

Basic Pushkey Command

The pushkey command for inserting the wait time is as follows:

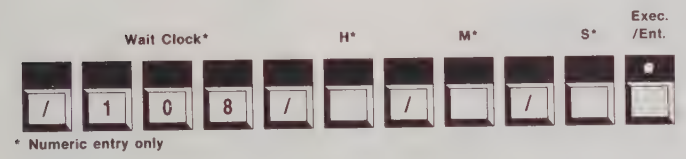
where H is the number of hours (0 to 23), M is the number of minutes (0 to 59) and S is the number of seconds (0 to 59).

4.2.30. Wait Clock [/] [108] – Extended Function No: 118

When a time is entered and **Wait Clock** is executed as part of a 100-step key push sequence, the 2313 waits until the entered time corresponds with the 2313 clock time before continuing with the sequence. A further feature is that if this function is repeated with the same time as previously used, this function is ignored. This enables a sequence to be performed a number of times where the 2313 waits for the clock the first time only. The key push sequence can be entered using **Enter Sequence** or edited using **Edit Sequence**.

Basic Pushkey Command

The pushkey command for inserting the wait clock time is as follows:



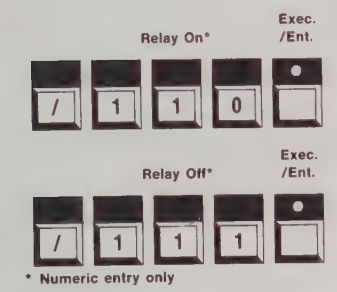
where H is the number of hours (0 to 23), M is the number of minutes (0 to 59) and S is the number of seconds (0 to 59).

4.2.31. Relay On [/] [110] – Extended Function No: 120
Relay Off [/] [111] – Extended Function No: 121

These are for inclusion in a 100-step key push sequence and permit remote switching of external equipment coupled to the **Remote Control** socket on the rear panel of the 2313. For example, by employing **Relay On** and **Relay Off** together with the **Wait Clock** and **Wait** functions an automatic control sequence may be developed which automatically switches on or off an external noise source at a preset time or time interval.

Basic Pushkey Command

The pushkey commands for activating **Relay On** and **Relay Off**, are as follows:



Opens relay contacts, switching on B&K Noise Source

Closes relay contacts, switching off B&K Noise Source

Relay On is factory preset to open circuit pins 2 and 5 of the **Remote Control** socket, while **Relay Off** interconnects them. This is directly suited for switching on and off the B&K Sound Power Source Type 4205 and Noise Source Type 4224 which may be coupled to the 2313 using a standard 8 pin DIN Cable AQ 0034. For switching the B&K Noise Generator Type 1405, a 8 to 7 pin DIN cable is used which has to be made up individually. Please consult the 1405 Instruction Manual.

For use with other external equipment which require a make/break connection for activation and deactivation, **Relay On** and **Relay Off** can be modified accordingly. This is done by carefully easing off the **Remote Control** socket lead from the interface board pin J8 shown in below and fitting it to pin J9 indicated. The interface board is mounted on the rear panel and is accessible on sliding off the top panel which is fastened by two screws on the back of the instrument. Before attempting to release the top panel ensure that the 2313 is disconnected from the mains supply.

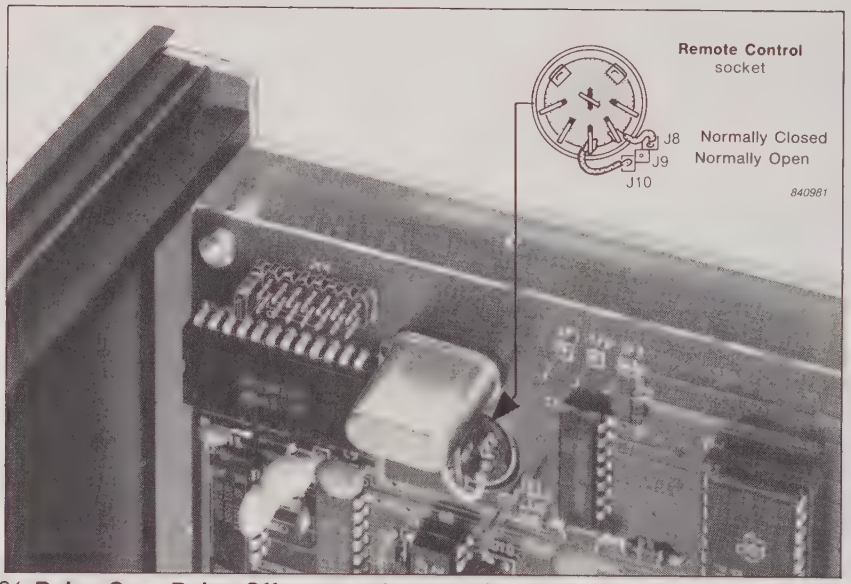


Fig. 4.31. **Relay On – Relay Off** *connections on the digital interface board of the 2313*

4.2.32. *Last* [1] — Sub Function No: 1

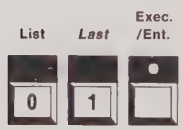
The ***Last*** sub function stores in Last Memory the latest operation performed by the 2313. ***Last*** may be used to list a measurement which was previously plotted, for example, or to transfer results to Memory or Continuous Memory etc. The types of measurement which may be stored are:

1/1, 1/3 and 1/12 octave spectra
Sound power spectra
Map files

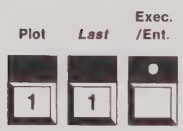
Last Memory is volatile and therefore information is retained as long as the 2313 is powered. If, however, an error arises during execution of an operation or measurement, then the information will be automatically deleted.

Basic Pushkey Commands

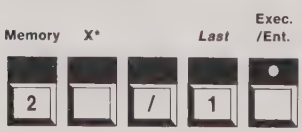
The basic pushkey commands uses the ***Last*** sub-function are:



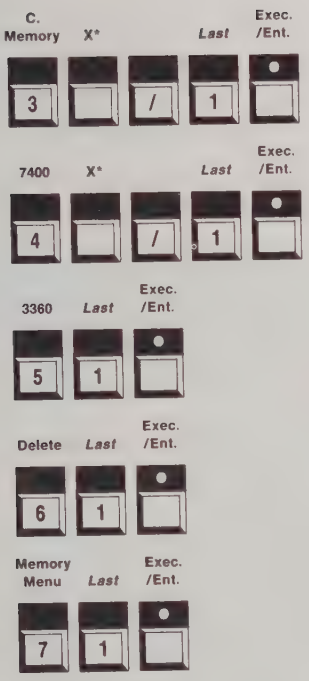
Lists previous measurement retained in Last Memory



Plots previous measurement retained in Last Memory



Stores previous measurement in Memory file X from Last Memory



Stores previous measurement in Continuous Memory file X from Last Memory

Records previous measurement in 7400 file X from Last Memory

Displays previous measurement on 3360 from Last Memory

Deletes previous measurement retained in Last Memory

Prints menu of previous measurement retained in Last Memory

where X can be assigned any memory file number between 0 and 31999, or tape file number between 1 and 1200, depending on the type of measurement, storage medium etc.

4.3. COMMON SETUP

The functions in the Common Setup are chosen using the Operating Set-Ups of the 2313 and once enabled they are automatically executed in parallel with most of the main documentation and storage functions of the apparatus

4.3.1. Print Lin. and "A"-Weight – Common Function No: 200

This function determines the Linear and "A"-Weighted level of a displayed measurement and once selected with the current Operating Set-Up is automatically executed each time the **List**, **Plot**, **Memory**, **Cont. Memory** or **Input Spectra** function is activated. After the determination of the Linear and "A"-weighted level, the result is included in the readout or stored together with other data related to the measurement.

Provided that **Lin. and "A"-Weight** is chosen prior to recording a 1/1, 1/3 or 1/12 octave measurement, then all subsequent lists and plots of the measurement will include this information, regardless of whether **Lin. and "A"-Weight** remains selected or not. For determination of the linear and "A"-weighted levels of stored measurements lacking this information, the measurements can be readback to the analyser using the **3360** function, and then either stored or documented with the **Lin. and "A"-Weight** function selected.

The linear and "A"-weighted level is determined by summing the RMS level of each 1/1 or 1/3 octave frequency band, in accordance with ISO 3741 Standard for determination of the sound power of noise sources. For the majority of signals this procedure is within

the accuracy and tolerance limits stated. However, where very low level and low frequency signals are measured, the accuracy will be reduced as it is assumed that the minimum level is never less than the base line level displayed by the analyser. In such cases it is always better to use the Linear and "A"-weight functions of the analyser rather than that built in the 2313.

Parameters

```
COMMON SETUP:
200 Print lin and A       1 Lin and A weight channel  : YES
```

1–Lin and A-weight: Can be set to **Yes** or **No**, with **Yes** as the default value.

Note: Lin. and "A"-weight determination with the 2313 is disabled if an Expansion Unit Type 5765 or Extension Unit WH 0490 is employed with the analyser.

4.3.2. Contour, 3D-expand - Common Function No: 201

This common function is used with the **Plot 3D** and **Plot Contour** functions to produce expanded plots of areas of particular interest, or to produce partial plots of larger measurement grids to avoid edge effects.

Parameters

```
COMMON SETUP:
201 Contour, 3D-expand 1 R, C-meas. points:  0  0
201 Contour, 3D-expand 2 Startpoint (R, C):  1  1
```

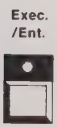
1–R, C-meas. points: These two numbers define the number of rows and columns in the expanded plot.

2–Startpoint (R, C): These two numbers define the origin in the full measurement array of the desired expanded plot.

Example of changing set-up parameters

Selects set-up no.1, function 201 and parameter no.1

Specifies the number of rows and columns to appear in the expanded plot e.g. 4 rows and 3 columns.



Selects the next parameter.

Specifies the origin of the row / column grid in the full size measured grid e.g. origin is set at row 2 and column 3.

Set-Up

Deactivates the set-up.

Activating of the function

When **Contour, 3D-expand** function 201, R,C-meas. point parameters are changed (i.e. the number of rows and number of columns are set to values other than 0), the resulting contour plots and 3-D plots will be expanded versions of the original plot with the number of rows and columns as specified. If the specified parameter values for the expanded plots are illegal, an error message is printed when the functions **Plot 3D** or **Plot Contour** are activated. If there are any measurement points outside the selected area the nearest points are included when interpolating to reduce edge effects.

Example of use of Contour, 3D-expand to avoid edge effects

A measurement grid consisting of 3 × 20 measurement points was marked out along a length of piping in a power station. An intensity spectrum was measurement at each point and the 60 spectra were stored on the 7400. To illustrate the edge effect, a composite contour plot of size 3 × 19 was made from 3 separate contour plots, with and without the use of Contour, 3D-expand; the twentieth column was ignored.

Without use of Contour, 3D-expand

In this case 3 separate contour plots of size 3 × 7 were produced and placed side by side, to yield a 3 × 19 contour plot. The last column in the first plot, was identical to the first column in the second plot. Similarly, the last column in the second plot was identical to the first column in the last plot. Therefore one would expect that where the plots overlap the contour lines would be smooth. A glance at columns 7 and 13 in Fig.4.32 shows that this is not the case. Note that in this figure 3 plots have been pasted together under one heading.

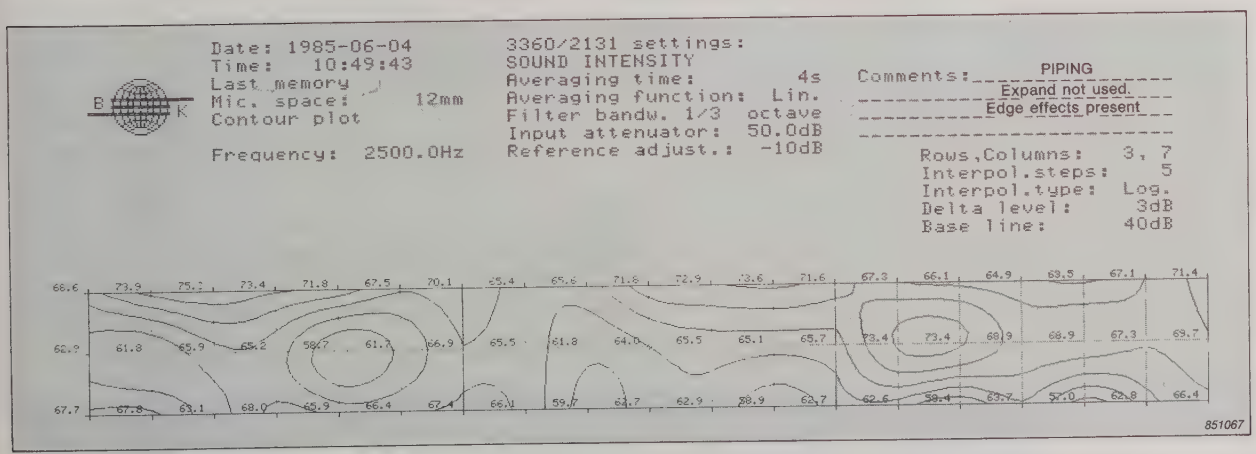


*Fig. 4.32. Three contour plots of size 3 × 7 pasted together to form a 3 × 19 plot. Contour, 3D-expand was **not** employed*

With use of Contour, 3D-expand

In this case the composite 3 × 19 contour plot was composed of 3 separate contour plots of sizes 3 × 7, each one calculated from measurement grids of sizes 3 × 8, 3 × 9, 3 × 8. The contour plots therefore overlapped one another so that interpolation yielded far smoother contours at the joins. See columns 7 and 14 in Fig.4.33 and compare the results to Fig.4.32.

To produce 3 overlapping contour plots

First plot

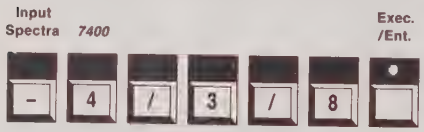
Set the **Input Spectra** parameters to the following values:

```
10 Input Spectra     3 7400 R, C-meas. points:    3    20
10 Input Spectra     4 7400 startpoint (R,C) :    1    1
10 Input Spectra     5 7400 first meas. file :    1
```

Set the **Contour, 3D-expand** parameters to the following values:

```
201 Contour,3D-expand 1 R, C-meas. points  :  3   7
201 Contour,3D-expand 2 Startpoint (R,C)   :  1   1
```

Read in a set of measurements of size 3 × 8 from the full 3 × 20 by pressing:



Produces a contour plot of size 3 × 7 for the 2500 Hz third octave band.

Second plot

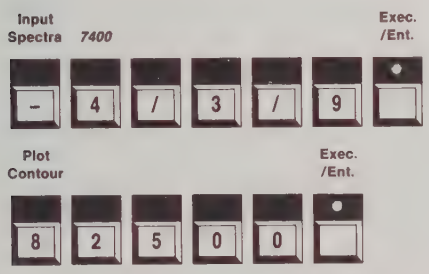
Set the **Input Spectra** parameter to the following values:

```
10 Input spectra  3 7400 R, C-meas. point  :  3  20
10 Input spectra  4 7400 startpoint (R, C) :  1   6
10 Input spectra  5 7400 first meas. file  :  1
```

Set the **Contour, 3D-expand** parameters to the following values:

```
201 Contour, 3D-expand 1 R, C-meas. points    :    3    7
201 Contour, 3D-expand 2 Startpoint ( R,C )   :    1    2
```

Read in a set of measurements of size 3 × 9 from the full 3 × 20 by pressing:



Produces a contour plot of size 3 × 7 for the 2500 Hz third octave band

Third plot

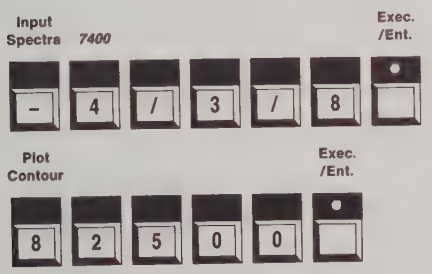
Set the **Input Spectra** parameters to the following values:

```
10 Input spectra    3 7400 R, C-meas. points    :    3   20
10 Input spectra    4 7400 R, startpoint ( R,C ):    1   12
10 Input spectra    5 7400 R, first meas. file  :    1
```

Set the **Contour, 3D-expand** parameters to the following values:

```
201 Contour,3D-expand  1 R, C-meas. point     :    3    7
201 Contour,3D-expand  2 Startpoint ( R, C )  :    1    2
```

Read in a set of measurements of size 3 × 8 from the full 3 × 20 by pressing.



Produces a contour plot of size 3 × 7 for the 2500 Hz third octave band.

The plot were then pasted together to produce Fig.4.33.

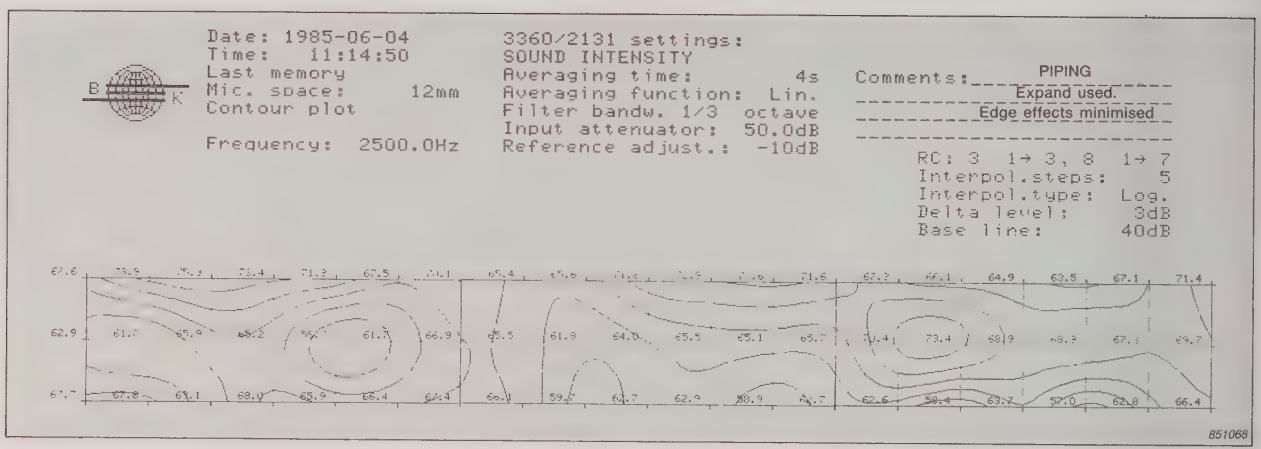


*Fig. 4.33. Three contour plots pasted together to form a 3 × 19 plot. Contour, 3D-expand **was** employed*

4.3.3. Contour, 3D-plot – Common Function No: 202

This common function is used with the **Plot 3D** and **Plot Contour** functions to adjust the appearance of the required plot.

Parameters

```
COMMON SETUP:
202 Contour, 3D-plot   1 Interpolation      : Default
202 Contour, 3D-plot   2 Base line          :    -1          dB
202 Contour, 3D-plot   3 Frequency interval :   100  10000  A-weight
202 Contour, 3D-plot   4 Mic. space         :    12          mm
```

1–Interpolation: The interpolation method may be set to linear, logarithmic or default by pressing **[.]** when the parameter is selected. If set to the default value, then linear interpolation is employed when the measured data contain both positive and negative intensity and logarithmic interpolation is employed when the measured data contains purely positive or purely negative intensity.

2–Base line: Determines the baseline level on the plot. If set to the default value of –1 then the baseline level is taken as the baseline level on the analyser.

3–Frequency interval: Determines the frequency interval of interest. The full frequency range is 1 Hz to 22000 Hz. Pressing the **Yes** pushbutton applies either the A-weighted or the linear level over the frequency range of interest.

4–Mic. space: Specifies the microphone spacing used in the probe during the measurement of the sound intensity data. If 50 mm spacing is employed then for intensity measurements the high frequency channels are set to the base line levels from the following channel/frequency:

Bandwidth	Channel	Frequency
1/1 octave	33	2000 Hz
1/3 octave	34	2500 Hz
1/12 octave	—	2722 Hz

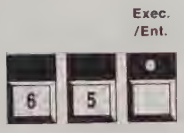
T00703GB0

Example of changing set-up parameters:

Selects set-up no.1, function 202 and interpolation parameter no.1

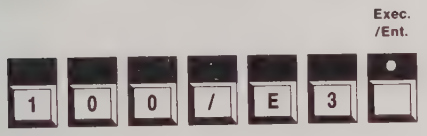
Pressing this pushkey changes the chosen interpolation method cyclically from Default to Linear to Logarithmic to Default to Linear etc.

Selects the baseline parameter.



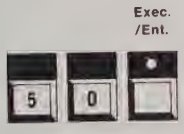
Sets the baseline level on the plot to 65 dB.

Selects the frequency interval parameter.



Specifies the frequency interval of the data to be displayed e.g. 100 Hz to 1000 Hz.

Selects the microphone spacing parameter.



Specifies 50 mm for the microphone spacing employed for the measurements.

Deactivates the set-up.

4.4. ERROR CODES

Error Codes 0 to 36 are generated by the internal software of the 2313 whereas Error Codes 104 to 123 are generated by the Application Package BZ 7004.

ERROR NO: 0

Paper drive and printing are inhibited. Fit new paper roll to restore normal operation.

Note: If the paper drive remains inhibited, the alignment of the paper sensor should be checked. See the separate Service Manual for the 2313

ERROR NO: 1

Attempt to alter Default Set-Up No: 0. Is possible with Operating Set-Ups No: 1, 2 and 3 only.

ERROR NO: 2

Attempt to enter clock data outside acceptable limits. Acceptable values are:

Year: 1900 to 9999
Month: 1 to 12
Day: 1 to 31
Hours: 0 to 23
Minutes: 0 to 59

ERROR NO: 3

Non existent Set-Up., i.e. Set-Up No: greater than 3

ERROR NO: 4

Non existent Function.

ERROR NO: 5

Non existent Parameter, i.e Parameter No: greater than that available with the particular function chosen. See Function and Parameter list.

ERROR NO: 6

Parameter value outside limits indicated by accompanying error message.

ERROR NO: 8

No room for saving measurement in C. Memory. If the measurement is newly generated one, it may be recalled from the Last Memory.

ERROR NO: 9

Attempt to save measurement exceeding maximum file number of C. Memory. If the measurement is a newly generated one, it may be recalled from the Last Memory.

ERROR NO: 10

Attempt to read Memory or Continuous Memory file (or activate 100 step control sequence) that does not exist. For file listing, activate **Menu** plus either the ***Memory*** or ***C. Memory*** function.

ERROR NO: 11

No room for saving measurement in Memory. If the measurement is newly generated one, it may be recalled from the Last Memory.

ERROR NO: 12

Attempt to save measurement exceeding maximum file number of Memory. If the measurement is a newly generated one, it may be recalled from the Last Memory.

ERROR NO: 13	Function requiring a processing capability outside the range of the working memory. For example, for recording a series spectra the maximum number of spectra which may be stored depends on whether averaging is selected or not.
ERROR NO: 14	Attempt to save measurement in a stored–secured Memory or Continuous Memory file already containing a measurement. If the measurement is a newly generated one, it may be recalled from the Last Memory.
ERROR NO: 15	Attempt to delete a Memory or Continuous Memory file safeguarded by the Delete–Secured function.
ERROR NO: 16	Attempt to activate a function via the IEC interface without first assigning control to the interface of the 2313 or entering the appropriate parameter values for the function.
ERROR NO: 17	Error in IEC data – not applicable with BZ 7004
ERROR NO: 18	Job specification error in data input to the IEC Interface of the 2313., i.e. non existent function or parameter formatting error.
ERROR NO: 19	IEC Time Out. No communication via the IEC interface or communication interrupted for a period lasting 5 seconds or more. Normally indicates minor fault with external equipment and/or connection of equipment not suited for use with BZ 7004. Check all interface cable connections, plus Power and Address Switch settings.
ERROR NO: 20	Attempt to read tape file not originating from the 2313. For processing of measurements recorded directly from the 2131 or 3360 without a 2313 in the setup, use of the ***7400 File to BZ 7004 File*** sub function is recommended.
ERROR NO: 21	Tape read error, caused by tape drop out, for example.
ERROR NO: 22	Attempt to read beyond last file present on tape. Normally occurs if non existent tape file named.
ERROR NO: 23	Attempt to save or read beyond end of tape.
ERROR NO: 25	No cassette inserted and/or lid of tape compartment not closed.
ERROR NO: 26	Substitution of tape file with memory file of the 2313 is not possible on account of different file sizes.
ERROR NO: 27	Attempt to overwrite or delete a write–protected Digital Tape Cassette.
ERROR NO: 28	Attempt to read incomplete tape file, the end of which has been damaged or accidently deleted during manual operation of the 7400.
ERROR NO: 29	Attempt to read a 7400 tape file not containing a soft function. To help locate the correct file, activate **Menu** plus ***7400***.
ERROR NO: 30	Error in tape file number when reading spectra recorded with the 7400 without a 2313 in the analysis set-up. During recording the 7400 allocates the file number which if not the same as that on which tape is stationed during reading, will result in an error message.

ERROR NO: 31	File substitution not possible due to the file substitution option fitted to the 7400. Refer to literature accompanying the 7400 option.
ERROR NO: 32	Illegal function or combination of functions. Check whether correct pushkey sequence has been used.
ERROR NO: 33	Execution of stored pushkey sequence not possible., i.e. sequence contains one or more illegal or non existent functions and parameters.
ERROR NO: 34	Wrong type of memory file for particular function requested. Use of Continuous Memory file instead of Memory file, for example.
ERROR NO: 35	Parameter value outside accepted limits. Press **Help** for details of value entered.
ERROR NO: 36	Execution of function not possible on account of incorrect series file interval. For file listing, activate **Menu** and either the ***Memory*** or ***Continuous Memory*** function.
ERROR NO: 104	One or more files of wrong data type., i.e. a mixture of 1/3 octave, 1/1 octave files etc.
ERROR NO: 107	Tape file originating from an Application Package other than BZ 7004 or BZ 7001. Replace BZ 7004 with appropriate Application Package.
ERROR NO: 108	Function cannot be performed due to overload of one or more measurement channels. Increase Input Attenuator range on analyser to resume operation without overload.
ERROR NO: 111	Attempt to convert 7400 file to BZ 7004 file which has already been correctly formatted by BZ 7004. Use **7400** function instead of ***7400 File to BZ 7004 File***.
ERROR NO: 112	Error in row / column specification.
ERROR NO: 113	Number of interpolation steps too high.
ERROR NO: 114	Data out of range. The result of an addition or subtraction lies outside the interval –99 to 300 dB
ERROR NO: 115	Expand specification error. Indicates that with Contour and 3D-plot that the expand specification in function 201, parameter 1 or function 201, parameter 2 is incorrect.
ERROR NO: 116	Too many rows or columns. Indicates that with Contour-and 3D-plot that the specified number of rows is greater than 10 or that the number of columns is greater than 15.
ERROR NO: 117	The frequency interval in function 202 parameter 3 is incorrectly specified.
ERROR NO: 118	Number of segments too small. There must be more than 1 segment when measuring sound power over a hemisphere.

ERROR NO: 119	For a partial measurement for Contour- or 3D-plot using function. **Input spectra from 7400**, the function 10, parameter 3 is incorrectly specified.
ERROR NO: 120	Error in segment, element specified. Indicated when using **Input Spectra** function during recording from analyser, if one wishes to return to some point in the measurement and the specification is incorrect.
ERROR NO: 121	Segment number does not exist. Indicated during surface specification one attempt to specify a non existant segment number.
ERROR NO: 122	Sum of width > radius. Indicated during specification of hemispherical surface if the sum of the specified segment width is greater that the radius of the hemisphere.
ERROR NO: 123	Number of measurement points too high. Indicated during surface specification if the specified number of measurement points in a particular segment exceeds 250.

4.5. WARNINGS

If during the implementation of a function, a fault should occur which is not serious enough to stop the function, then a warning will be indicated when **Plot** or **List** of the result is used. These warnings are situated in the heading bounded by double asterisks **.

The warnings are:

DIFFERENT SETTINGS:	Indicated when the settings on the analyser are changed
OVERLOAD:	Overload is indicated when there is a digital overflow on the digital output.

5. USE WITH SIGNAL ANALYZERS TYPES 2032 AND 2034

As with other Application Packages available for the 2313, BZ 7004 is capable of producing hard-copy graphic plots of measurements presented on the display screen of the Dual Channel Signal Analyzers Types 2032 and 2034. Each copy takes approximately 10 seconds to produce and is fully annotated so that there are no control settings to note.

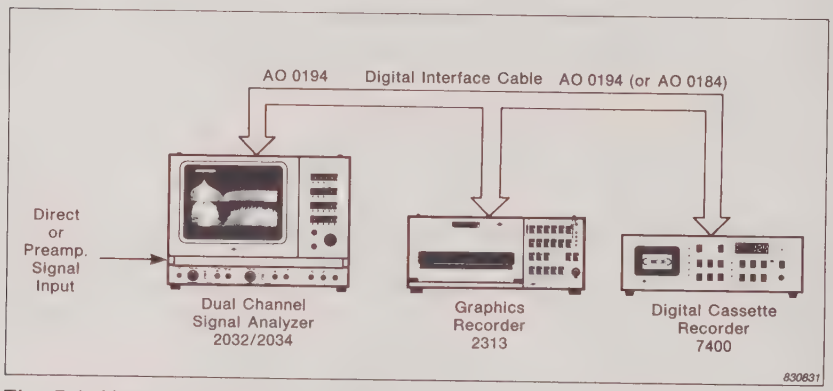


Fig. 5.1. Use of the 2313 Graphics Recorder with a 2032 or 2034 Dual Channel Signal Analyzer plus 7400 Digital Cassette Recorder

Interconnection and initial setting up of the recording and analysis equipment is similar to that described in section 4.1, except that "System Controller – Not Active" mode must be selected using the **Address Switch** of the 2313. This disables local front panel activation of the documentation, storage and measurement functions designed for 2131 and 3360 Analyzers, enabling the 2313 to serve as a conventional dot-matrix printer when its **Reset** plus **Exec./Ent.** keys are pressed. A hard copy of the measurement displayed on the 2032 or 2034 may then be obtained simply by pressing the **Digital I/O** "Plot" key of the Analyzer. By including a 7400 Digital Cassette Recorder in the setup (see Fig.5.1), simultaneous recording and storage of measurements is possible. Alternatively, where it is required to confine readout to only one instrument at a time, then either the 2313 or 7400 may be deactivated by pressing their **Reset** or **Stop** key.

Note: Although 2032 and 2034 **Digital I/O** "Plot" files may be documented using the 2313, they cannot be re-displayed on the 2032 or 2034. For this purpose it is recommended that measurements are recorded using the **Digital I/O** "Output" key of the Analyzers to initiate read out to the 7400.

Where more than just a screen plot is required, the 2313 may be used with Application Package BZ 7006. BZ 7006 extends the capabilities of 2032 and 2034 to include $^1/_1$ and $^1/_3$ octave synthesis, envelope analysis and provides automatic input and output to a 7400. The 2313 plot functions are expanded to include display and plot of two super imposed graphs as well as several other user definable plot modifications.

For further information on the use of the 2032 or 2034 Signal Analyzers, their Instruction Manuals should be consulted.

6. DATA TRANSFER AND REMOTE CONTROL VIA THE IEC INTERFACE

6.1. INTRODUCTION

The digital interface of the Type 2313 is designed according to the standard IEC 625-1 "Interface for Programmable Measuring Apparatus Byte-Serial Bit Parallel". Since the only significant difference between this and the IEEE Standard 488 – 1978/ANSI MC1.1 – 1975 is the type of connector used, compatibility with these standards is only a question of which connecting cable is used. Connection of the Type 2313 to an IEC 625-1 interface bus system is made from the IEC BUS connector on the rear panel of the Type 2313 using cable AO 0194. Connection to an IEEE/ANSI interface bus system is made from the same connector using cable AO 0194 and adaptor AO 0195. Connection to an earlier B & K instrument fitted with a female, slide-lock connector, is made using cable AO 0184. For further details of instrument interconnections, refer to the B & K publication "INTERFACING BRÜEL & KJÆR INSTRUMENTS".

It is important to note that although the Type 2313 interface is designed according to the IEC standard, absolute compatibility with IEC or IEEE/ANSI interfaces designed by other manufacturers cannot be unconditionally guaranteed, since differences can occur within the limits of the specifications. Any problems encountered, however, will be of a software rather than a hardware nature. Where compatibility is in doubt, contact our local representative for details.

6.2. IEC FUNCTIONS IMPLEMENTED

The interface of the Type 2313 implements the following functions, as specified by the IEC standard. The clauses referred to are the relevant sections of the IEC publication specifying the functions. The equivalent sections in the IEEE/ANSI standard are given in parentheses.

Clause 6, Source Handshake (SH) Interface Function, (Section 2,3)
SH 1 — complete capability
Clause 7, Acceptor Handshake (AH) Interface Function, (Section 2,4)
AH 1 — complete capability
Clause 8, Talker (T) Interface Function, (Section 2,5)
T5 — complete capability
Clause 9, Listener (L) Interface Function, (Section 2,6)
L3 — complete capability
Clause 10, Service Request (SR) Interface Function, (Section 2,7)
SR 1 — complete capability
Clause 11, Remote Local (RL) Interface Function, (Section 2,8)
RL 1 — complete capability
Clause 12, Parallel Poll (PP) Interface Function, (Section 2,9)
PP 1
Clause 13, Device Clear Interface (DC) Function, (Section 2,10)
DC 1 — complete capability

Clause 15, Controller Interface (C) Function, (Section 2,12)

- C1 — system controller
- C2 — send interface clear (IFC) and take charge
- C3 — send remote enable (REN)
- C4 — respond to service request (SRQ)
- C5 — send interface messages, receive control, pass control, pass control to self, parallel poll, take control synchronously

All other functions no capability

For further details of the above functions, refer to the relevant sections of the IEC or IEEE/ANSI standards.

6.3. ADDRESSING THE TYPE 2313

Each device in an IEC interface bus system has at least one listener and/or talker address depending on its function. When an interface controller contacts a device over the IEC interface, it sends a device address, which will contain the appropriate talker or

ASCII Address Characters		ADDRESS SWITCH					Address Code	
Listen	Talk	A5	A4	A3	A2	A1	decimal	octal
SP	@	0	0	0	0	0	0	0
!	A	0	0	0	0	1	1	1
"	B	0	0	0	1	0	2	2
#	C	0	0	0	1	1	3	3
$	D	0	0	1	0	0	4	4
%	E	0	0	1	0	1	5	5
&	F	0	0	1	1	0	6	6
'	G	0	0	1	1	1	7	7
(	H	0	1	0	0	0	8	10
)	I	0	1	0	0	1	9	11
*	J	0	1	0	1	0	10	12
+	K	0	1	0	1	1	11	13
,	L	0	1	1	0	0	12	14
-	M	0	1	1	0	1	13	15
.	N	0	1	1	1	0	14	16
/	O	0	1	1	1	1	15	17
0	P	1	0	0	0	0	16	20
1	Q	1	0	0	0	1	17	21
2	R	1	0	0	1	0	18	22
3	S	1	0	0	1	1	19	23
4	T	1	0	1	0	0	20	24
5	U	1	0	1	0	1	21	25
6	V	1	0	1	1	0	22	26
7	W	1	0	1	1	1	23	27
8	X	1	1	0	0	0	24	30
9	Y	1	1	0	0	1	25	31
:	Z	1	1	0	1	0	26	32
;	[	1	1	0	1	1	27	33
<	\	1	1	1	0	0	28	34
=	]	1	1	1	0	1	29	35
>	^	1	1	1	1	0	30	36

T00078GB0

Table 6.1. 2313 Address Switch settings (shaded area factory setting)

listener address. This address is in ISO 7-bit code (or equivalent ASCII), bit 8 being unused for addressing, therefore remaining at logic 0. Table 6.1 gives a list of possible ADDRESS SWITCH settings with the corresponding device address in the form of ASCII characters for the different address modes.

Note that in a system where the Type 2313 is a controller, it is not necessary to set the address of the 2313 in order to operate the system. It will, however, be necessary to set the addresses of the other instruments in the system to their factory setting, which can be found in the relevant instruments instruction manual or on the label attached to the Application Package.

6.3.1. Setting the Address Switches

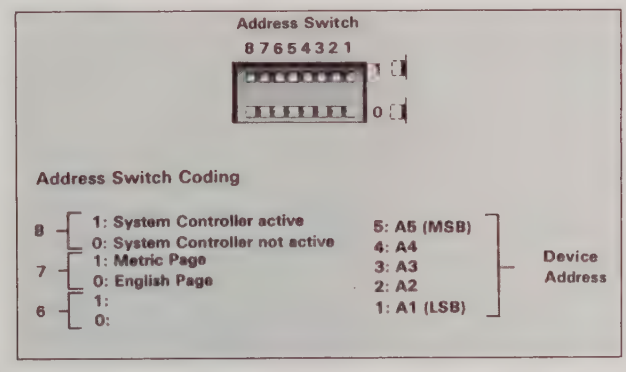


Fig. 6.1. Address Switch on the rear panel of the 2313

The listen and talk addresses over which the 2313 can be contacted via its IEC interface are selected by the **Address Switches** on the rear panel. For each switch pair, depressing the upper switch will give a logic 1 and depressing the lower switch will give a logic 0. The most significant bit (MSB) of the address is given by switch pair A5, while the least significant bit (LSB) is given by switch pair A1.

Switch pair 6 is unused, whilst switch pair 7 is for setting the page size to "English" or "Metric".

Switch pair 8 is for activating or deactivating the 2313 as a system controller. When set at logic 0 ("System Controller not active"), the system controller function of the 2313 is deactivated, which enables the "Listen Only" mode to be activated manually (Section 6.4.1), or enables the 2313 to be operated remotely as described in Sections 6.4 to 6.12. This might imply that the 2313 works as an IEC controller but not as a system controller. However, the functions in the Application Package, as described in Section 1, may still be utilised. When set at logic 1 ("System Controller active"), the system controller function is activated and the 2313 can be used via its front panel pushbuttons to control itself and other instruments depending on the Application Package used (see Section 1). If the 2313 is to be used as a system controller then Sections 6.4 to 6.12 may be ignored.

On delivery, **Address Switch** numbers A1 to A5 on the rear panel of the Type 2313 are set to 00001, and switch pair 8 set to "System Controller active". Other address codes may be selected as required without influencing the operation of the 2313. In a 2313/BZ 7004 system with the Type 3360 and Type 7400, it is not necessary to set the address switches A1 to A5 of the 2313.

Note that after activating any of the switches, it is necessary to press "Reset" or power off and then power on again.

6.4. MODES OF OPERATION

The following sections (6.4 to 6.12) require that **Address Switch** 8 is set to "System Controller not active", and A1 to A5 are set according to the system controller's program.

6.4.1. Listen Only Mode

In this mode, the 2313 will print out any data on the interface bus. This mode is accessed manually by pressing **Reset** followed by **Exec./Ent.**

The **Listen**, **Entering** and **Exec./Ent.** LEDs will illuminate, indicating that the 2313 is in the "Listen Only" mode and ready to print data as described in Section 6.12.

Note: To return to the normal remote controllable mode, press Reset manually or clear the 2313 via the interface bus by sending ⟨DCL⟩, ⟨SDC⟩ or ⟨IFC⟩.

6.4.2. Remote/Local Operation

In addition to manual control, the 2313 can be controlled via the interface bus. Three control modes exists:

Local Mode: Some front panel controls can be used by the operator. Full manual control requires that switch 8 is set to "System Controller active" or the 2313 has received the MASTER Job (Section 6.6.3). Avoid using the Set-Up mode except for setting the clock.

Remote Mode: The 2313 can be controlled either remotely, or manually as in local mode.

Remote Mode with Local Lockout: Only remote control is possible, however, it is still possible to carry out a manual Reset.

6.5. THE INTERFACE JOB

Section 6.4.1 describes how to manually bring the 2313 in a mode ready for printing. For remote control over the interface bus, various Jobs can be specified, a list of which is given in Table 6.2.

A general diagram of the Job syntax is given in Fig. 6.2. The 'Job Header' describes the job to be carried out. This consists of one word which may be written in its entirety but may be shortened at least until the underlined part of the word.

Example: PRINTER ⟨LF⟩ or
PRINT ⟨LF⟩ or
PR ⟨LF⟩

will give the same result.

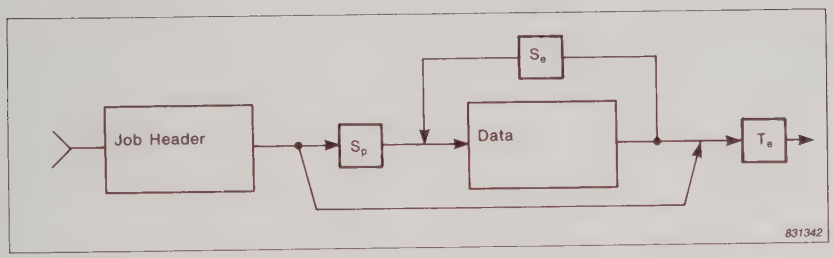


Fig. 6.2. Job syntax diagram

The 'Data', if present, is used to further specify the job. To separate the 'Job' from the Data, a separator S_p is used. Data may be formatted by a Separator S_e. The Job specification ends with a terminator T_e. The following separators and terminator are used:

S_p = ⟨Space⟩

S_e = ⟨ , ⟩

T_e = ⟨LF⟩ or ⟨EOI⟩ with any character.

The character to be sent is the character **between** the brackets – not the brackets themselves. Errors in the job specification will cause the 2313 to send an SRQ (Service Request) if the Service Request function is enabled by the Job specification SRQENABLE (see Section 6.6.11), otherwise an error message will be printed and the 2313 will lock up. After pressing 'Reset' to clear the lock up, the Service Request function will be disabled.

6.6. JOBS IN THE BZ 7004

This Section gives a descripton of each of the Jobs available in the BZ 7004 accompanied by a syntax diagram and an example of a program line. A list of interface Jobs is given in Table 6.2. Note that the word can be shortened up to the underlined part, e.g., 'DEFAULT' can be written as 'D', 'DE', 'DEF', etc.

Interface Job	Section	Interface Job	Section
DEFAULT	6.6.1.	SRQENABLE	6.6.11.
FUNCTION	6.6.2.	SRQDISABLE	6.6.11.
MASTER	6.6.3.	TEST	6.6.12.
NEWSETUP	6.6.4.	TEXT0	6.6.13.
PAGE	6.6.5.	TEXT1	6.6.13.
PRINTER	6.6.6.	TEXT2	6.6.13.
REPEAT	6.6.7.	TEXT3	6.6.13.
RETURNADR	6.6.8.	TEXT4	6.6.13.
SETUP	6.6.9.	TOPPAGE	6.6.14.
SHOWTIME	6.6.10.		

T00208GB0

Table 6.2. List of interface Jobs in alphabetical order

6.6.1. DEFAULT

Sets the current Set-Up parameter values to default (from Set-Up 0).

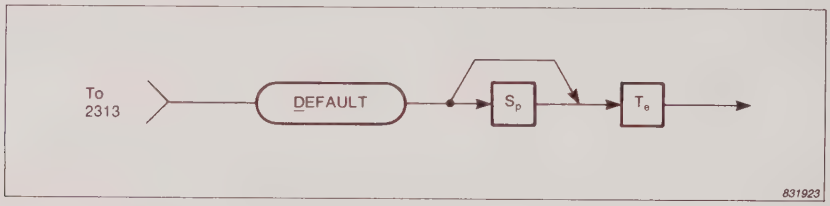


Fig. 6.3. Syntax diagram for changing the current Set-Up to default values

Example of Use

DEFAULT T_e

6.6.2. FUNCTION

In the preceeding chapters, it is described how to use the 2313 functions such as **List**, **Plot** etc. The syntax diagrams in these chapters describe how to select functions and their associated parameters. The same functions and their parameters may be selected via the interface, using other separators between the function and parameter.

No.	Main Function Name
0	List
1	Plot
2	Memory
3	Cont. Memory
4	7400
5	3360
6	Delete
7	Memory Menu
8	Plot Contour
9	Plot 3D
10	Input Spectra

No.	Extended Function Name
11	1/12 oct. Source Location
12	Modify Spectrum
13	Edit Surface
28	Multi Subtract
29	Multi Add
120	Relay On
121	Relay Off
122	Set Unit Index*

* see text

T00527GB0

Table 6.3. List of BZ7004 main and extended functions selectable over the interface using the given function number

No.	Sub-function Name
1	*Last*
2	*Memory*
3	*C. Memory*
4	*7400*
5	*3360*
16	*1/12 Octave*
17	*Sound Power*
18	*Subtract*
19	*Add*
20	*Surface*
24	*7400 file to BZ7004 file*

T00529GB0

Table 6.4. List of BZ7004 sub-functions selectable over the interface using the given sub-function number

Fig. 6.4 gives a general syntax diagram to activate one of the BZ 7004 functions listed in Table 6.3. The sub-functions are listed in Table 6.4, where the no. in brackets is used when accessing the sub-function in the Set-Up. Note, however, that sub-function numbers 6 and 7 cannot be accessed in the Set-Up for the BZ 7004 package. Detailed information on parameters can be found in the description of the actual function in the previous sections. As an example, a syntax diagram of the function 'Plot', is given in Fig. 6.5.

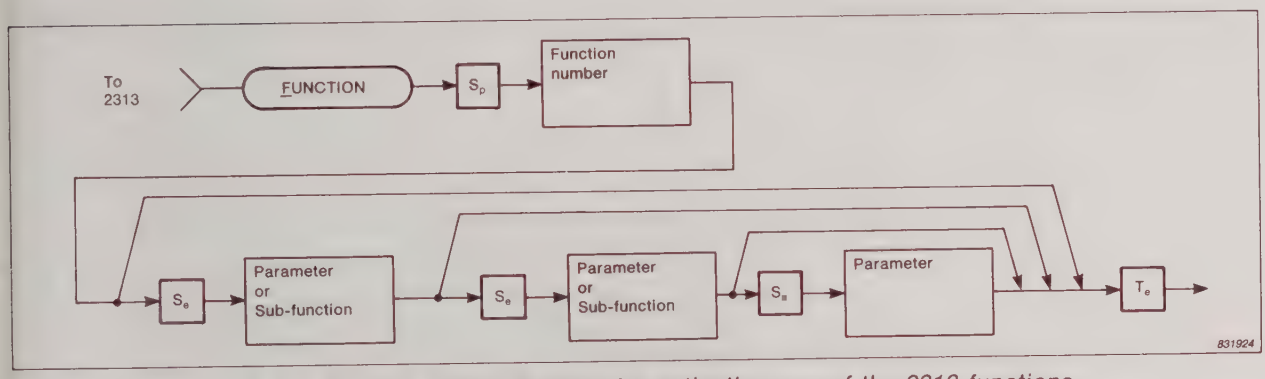


Fig. 6.4. General syntax diagram for activating one of the 2313 functions

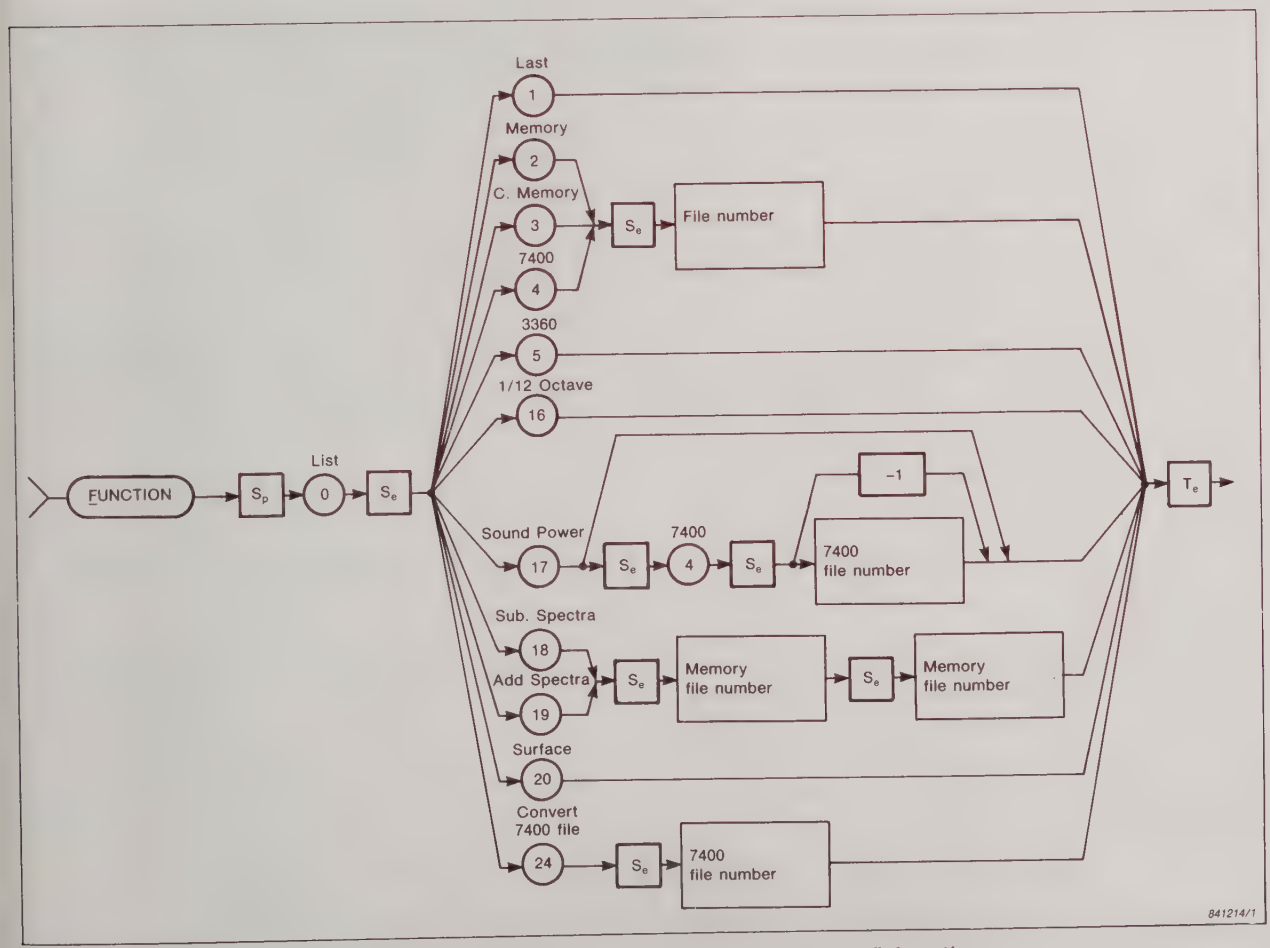


Fig. 6.5. Syntax diagram for activating the "List" function

Examples of Use

RETURNADR R T_e
FUNCTION 1 , 19 , 3 , 8 T_e — Performs the subfunction **Add** on the spectra in Memories 3 and 8 and plots the results
〈TCT〉 — The control character commands the 2313 to take control

This example will result in plotting of an addition of files 3 and 8.

FUNCTION 122 , 202 , 3 , 0 T_e — Sets the Unit field for the Common setup Contour, 3D-plot function parameter number 3 to Lin.

Notes

Function no. 123 in Table 6.4 is used for setting the UNIT field in the Set-Up and can only be accessed over the interface.

The system controller must not operate the 2313 until the function is executed and the 2313 has passed the control back to the system controller.

The 2313 gives up control on completion of the function, therefore this Job should be preceded by RETURNADR (Section 6.6.8). The selected 2313 function will be initiated on passing control to the 2313.

6.6.3. MASTER

Allows the 2313 to be controlled manually using the front panel pushkeys (or remote terminal — see Section 7).

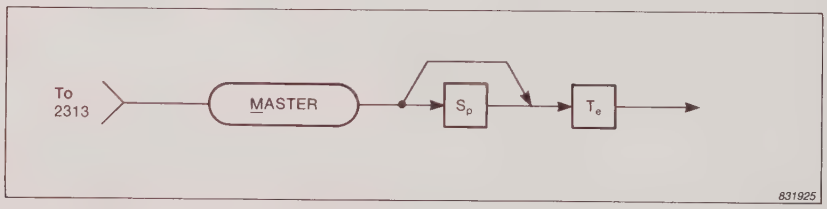


Fig. 6.6. Syntax diagram for controlling the 2313 via the front panel

Example of Use

MASTER T_e
〈TCT〉 — The system controller passes control to the 2313.

Notes

This Job should be followed by passing control of the bus to the 2313, see Section 6.7. Control is released when 'Reset' is activated. The system controller may take control by sending 〈IFC〉.

6.6.4. NEWSETUP

Specifies which of the 4 Set-Ups is to be the current Set-Up.

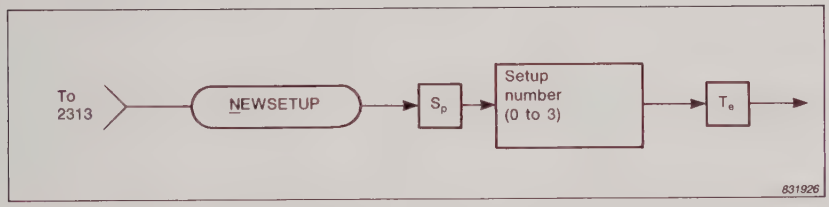


Fig. 6.7. Syntax diagram for selecting current Set-Up

Example of Use

NEWSETUP 2 T_e Selects Set-Up number 2 to be the current Set-Up

6.6.5. PAGE

The remainder of a page will be fed.

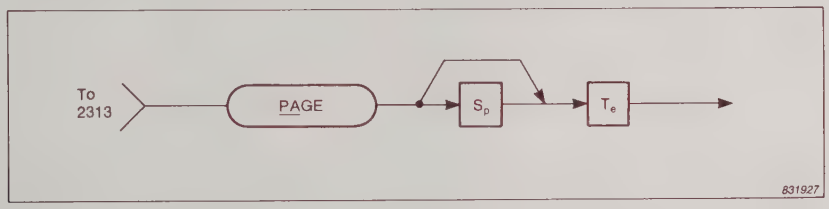


Fig. 6.8. Syntax diagram for paper feed of the remainder of the page

Example of Use

PAGE T_e

Notes

The page size is determined by the setting of the **Address Switch** pair 7.

6.6.6. PRINTER

Brings the 2313 to work in a printer mode as described in Section 6.12.

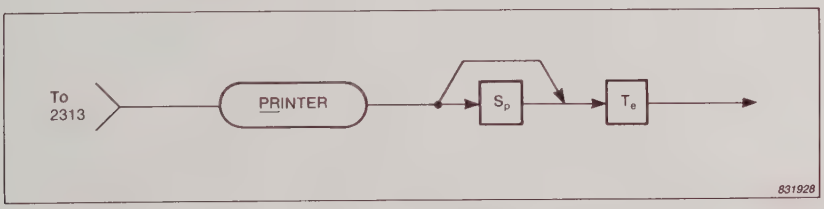


Fig. 6.9. Syntax diagram for selecting printer mode

Example of Use

PRINTER T_e

Notes

Once set, the 2313 will remain in the printer mode until cleared remotely (Section 6.11), or by pressing **Reset** on the front panel.

6.6.7. REPEAT

Repeats the previously executed FUNCTION or TEST. Has the same effect as pressing **Exec./Ent.** in manual mode.

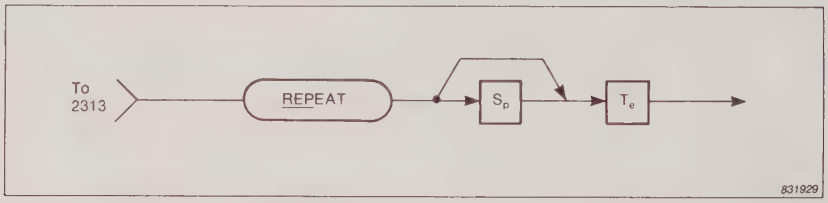


Fig. 6.10. Syntax diagram for repeating previous FUNCTION or TEST

Example of Use

RETURNADR S T_e
REPEAT T_e
〈TCT〉

The control character 〈TCT〉 commands the 2313 to take control.

Notes

See Section 6.7 for further information on passing control.

The 2313 gives up control on completion of the function, therefore this Job should be preceeded by RETURNADR (Section 6.6.8). The selected 2313 function must be started by passing control to the 2313.

The system controller must not operate the 2313 until the repeated function is executed and the 2313 has passed the control back to the system controller. This time depends heavily on the repeated function.

6.6.8. RETURNADR

Specifies the address to which control should be returned on completion of a function which requires that the 2313 has control over the interface. This specification must always preceed the following jobs: FUNCTION, MASTER, REPEAT, TEST.

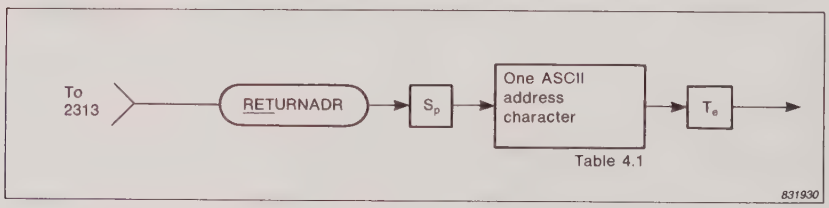


Fig. 6.11. Syntax diagram for specifying return address

Example of Use

RETURNADR U T_e

Enables control to be returned to a system controller with an address corresponding to the ASCII character 'U' (decimal 85)

Notes

This return address will be remembered by the 2313 until the 2313 is cleared by 〈DCL〉, 〈SDC〉 or in the case of an aborted function by 〈IFC〉.

6.6.9. SETUP

Enables new parameter values to be added to the current Set-Up.

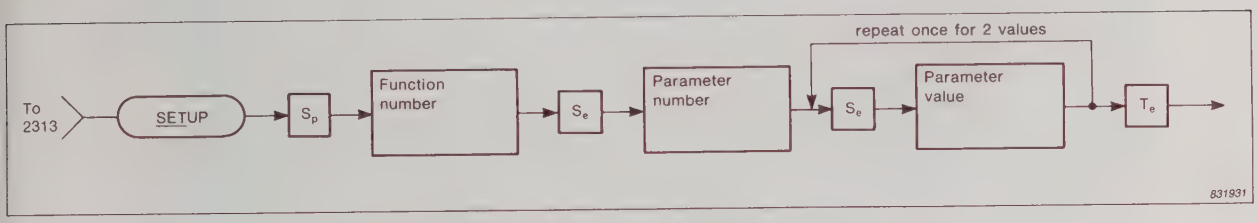


Fig. 6.12. Syntax diagram for changing Set-Up values

Example of Use

SETUP 1 , 3 , 500 T_e	Plot from 500 Hz
Wait	
〈SDC〉	
SETUP 2 , 1 , 3 , 12 T_e	Memory 3 to 12 store-secured
Wait	
〈SDC〉	
SETUP 9 , 1 , 60 T_e	3D-plot range 60 dB
Wait	
〈SDC〉	
SETUP 18 , 1 , 0 T_e	Subtract spectra not arithmetical
Wait	
〈SDC〉	
SETUP 200 , 1 , –1 T_e	Add lin and A-weight channels
Wait	
〈SDC〉	

Notes

Note the necessity of sending an 〈SDC〉 or a 〈DCL〉 after each Set-Up command. After the SETUP command and before the clear, a wait of 20 msec. is necessary. A check as described in Section 6.7 and 6.8 may be performed.

From the list in Fig. 6.13 of the BZ 7004 functions, one can obtain function numbers, parameter numbers and values. This list contains default values i.e. from Set-Up 0. Note that it is not possible to change the UNIT using the SETUP function, instead use function no. 122 (see Section 6.6.2).

The parameter values **Yes** and **No** are selected by writing –1 for **Yes** and 0 for **No**.

To select another Set-Up, use NEWSETUP (Section 6.6.4).

```
SELECTED SETUP NO.: 0
    FUNCTION              PARAMETER                        VALUE          UNIT
  0 List                1 List from                   :     0             Hz
  0 List                2 List to                     :  22000             Hz
  0 List                3 Including head              : YES
  1 Plot                1 Graphic offset              :     0             dB
  1 Plot                2 Scale proportion, 25dB/     :     5             cm
  1 Plot                3 Plot from                   :     0             Hz
  1 Plot                4 Plot to                     :  22000             Hz
  2 Memory              1 Store-secured               :    -1     -1
  3 Cont.memory         1 Store-secured               :    -1     -1
  6 Delete              1 Memory secured              :    -1     -1
  6 Delete              2 Cont. memory secured        :    -1     -1
  8 Contour plot        1 Interpolation steps         :     5
  8 Contour plot        2 Grid                        : YES
  8 Contour plot        3 Contourline/                :     5             dB
  8 Contour plot        4 Show all measure levels     : YES
  9 3D plot             1 Range                       :    70             dB
  9 3D plot             2 Grid                        : YES
  9 3D plot             3 Viewangle                   :    30
  9 3D plot             4 Viewcorner                  :     1
 10 Input spectra       1 Channel selector freq.      :  1000
 10 Input spectra       2 7400 read 3360 settings     : YES
 10 Input spectra       3 7400 R, C-meas. points      :     0      0
 10 Input spectra       4 7400 startpoint ( R, C )    :     1      1
 10 Input spectra       5 7400 first meas. file       :     1
 10 Input spectra       6 7400 spectrum type          :  Pressure:  Ch B
 10 Input spectra       7 If from 3360 then -> 7400   : NO
 10 Input spectra       8 Partial remeasurement       : NO
 10 Input spectra       9 Seper. Lin. Averag. start   : NO
(/100) 110 Personal text 1 Enable line 0              : NO
(/100) 110 Personal text 2 Enable line 1              : NO
(/100) 110 Personal text 3 Enable line 2              : NO
(/100) 110 Personal text 4 Enable line 3              : NO
(/100) 110 Personal text 5 Enable line 4              : NO

  SUBFUNCTIONS:
 16 1/12 octave         1 Man. scan                   : NO
 16 1/12 octave         2 Valid low freq. in auto.    :    80             Hz
 17 Sound power         1 Surface                     : General
 17 Sound power         2 Number of segments          :     1
 17 Sound power         3 Frequency interval          :   100    10000 Hz
 17 Sound power         4 Radius                      :  1.0000E+00     m
 17 Sound power         5 Print current results       : NO              m
 18 Subtract spectra    1 Arithmetical                : NO
 19 Add spectra         1 Arithmetical                : YES

  COMMON SETUP:
200 Print Lin and A     1 Lin and A weight channel    : YES
201 Contour, 3D-expand  1 R, C-meas. points           :     0      0
201 Contour, 3D-expand  2 Startpoint (R, C)           :     1      1
202 Contour, 3D-plot    1 Interpolation               : Default
202 Contour, 3D-plot    2 Base line                   :    -1             dB
202 Contour, 3D-plot    3 Frequency interval          : 100 10000 A-weight
202 Contour, 3D-plot    4 Mic. space                  :    12             mm
```

OP2313CA0

Fig. 6.13. 2313 listing of BZ 7004 functions with function numbers, parameters with parameter numbers and default values

6.6.10. SHOWTIME

Results in a print-out of date and time.

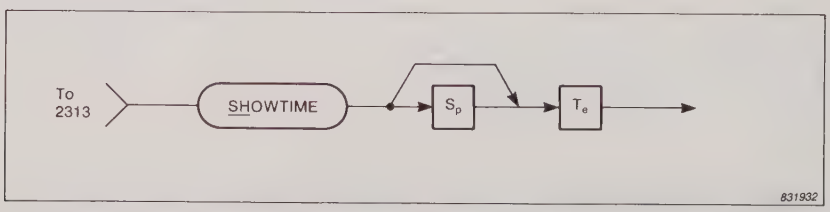


Fig. 6.14. Syntax diagram for read-out of date and time

Example of Use

SHOWTIME T_e

6.6.11. SRQENABLE SRQDISABLE

SRQENABLE enables the 2313 to send out a service request (SRQ) in the case of a Job specification error, an error during the Job, or lack of paper.

SRQDISABLE disables the 2313 from sending out a service request.

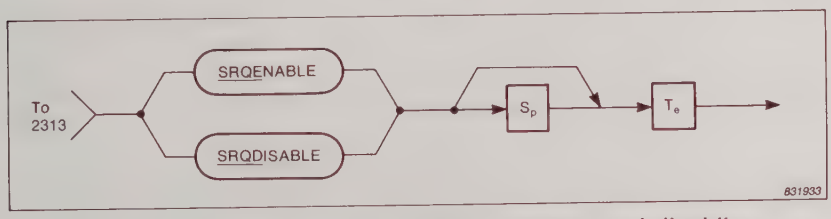


Fig. 6.15. Syntax diagram for SRQ enabling and disabling

Example of Use

SRQENABLE T_e

Notes

When an error occurs, the 2313 will lock until a serial poll has been carried out (see Section 6.10), or until the 2313 is cleared (See Section 6.11).

6.6.12. TEST

Carries out a test of the 2313 and gives a print-out for inspecting the printer head quality.

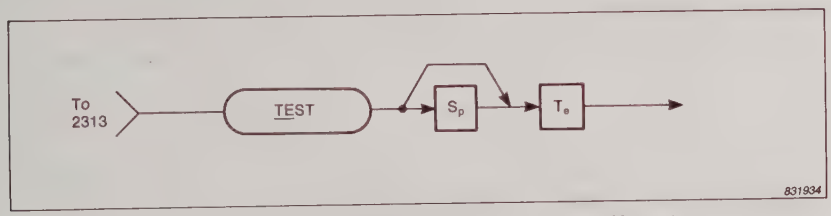


Fig. 6.16. Syntax diagram for 2313 self-test

Example of Use

RETURNADR W T_e
TEST T_e
〈TCT〉

The control character 〈TCT〉 commands the 2313 to take control

Notes

See Section 6.7 for further information on passing control.

This command must be preceeded by RETURNADR (Section 6.6.8), for returning control on completion of the test, and control should be passed to the 2313 in order to start the

test. The system controller must not operate the 2313 until the test is finished and the 2313 has passed control back to the system controller (approx. 3 minutes).

6.6.13. TEXT0
TEXT1
TEXT2
TEXT3
TEXT4

Inserts text in the relevant textline.

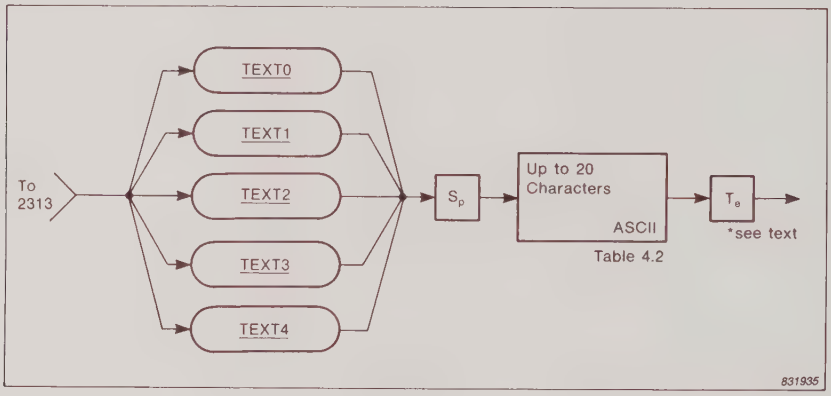


Fig. 6.17. Syntax diagram for inserting text in the read-out textlines

Example of Use

TEXT0 1/12 Octave Spectrum 〈EOI〉 Inserts '1/12 Octave Spectrum' in textline 0 (top textline)

Notes

* 〈EOI〉 with the last character should be used as T_e and not 〈LF〉. If, however, the control characters including 〈LF〉 are used, then the special characters from Table 6.6 will appear in the text field, e.g., 〈LF〉 would give a ^{0}.

Each textline contains a maximum of 20 characters.

6.6.14. TOPPAGE

The current position will be defined as the top of page.

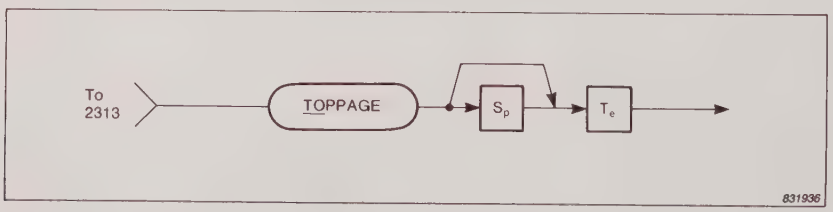


Fig. 6.18. Syntax diagram for setting the current position to top of page

Example of Use

TOPPAGE T_e

6.7. CHECKING THE JOB SPECIFICATION

During the development phase of the control program, it will be useful to know whether the job specifications sent to the 2313 are correct. In this case, the system controller must look for a Service Request 〈SRQ〉 message on the bus, (if service request is enabled), until the 2313 has checked the message.

It is important that the Take Control 〈TCT〉 message, if relevant, is not sent until the check is finished, as it is impossible for the system controller to perform a serial poll after it has passed the control to the 2313.

6.8. CHECKING FOR JOB ERRORS

Even if the job specification syntax is correct, the parameter numbers or values may be wrong.

While waiting for the 2313 to carry out its job, look for a possible service request 〈SRQ〉 message from the 2313.

Note that errors detected by the 2313 while having the IEC control, will lock the 2313 and can therefore not be investigated by the system controller. Such errors require an interface clear 〈IFC〉 which must be sent by the system controller after it has waited unsuccesfully for the job to finish. However, if the error is due to lack of paper, the 2313 will not lock but will send a service request 〈SRQ〉 message, if enabled, after it has completed the job.

6.9. ERRORS BY REMOTE CONTROL

Some typical errors which can occur are:

1. Forgetting to specify the return address for the system controller when required will result in:

   Job specification error Error No.: 18

2. Forgetting to pass control to the 2313 when required gives after about 5 seconds:

   IEC timeout Error No.:19

3. Misspelling job specifications gives:

   Job spec. error Error No.:18

4. Operating the system controller before the 2313 has passed the control back to the system controller will probably result in an error message from the system controller.

5. Wrong parameter no. or value used in SETUP gives various Error print outs — see error list in section 4.6.

For error printouts other than mentioned here please see the error list in section 4.6.

6.10. POLLING THE STATUS OF THE 2313

If the Service Request function is enabled (see Section 6.6.11), an error will cause an SRQ (Service Request signal — see Section 6.7 and 6.8). To locate the device asking for service and to get information about the cause of the error, a serial poll can be carried out by the system controller. The status byte of the 2313, read by the system controller carries the information stated in Table 6.5.

Bit No.	Status Message
8	*(not used and set false i.e. 0)*
7	2313 is asking for service
6	2313 is in an abnormal condition
5	2313 is busy carrying out a job
4	2313 is out of paper
3	*(not used and set false i.e. 0)*
2	2313 has detected a Job error
1	2313 has detected a Job specification error

T00209GB0

Table 6.5. Table of 2313 Status Messages

At the same time as bit 4 is set the 2313 will print:

Printing not allowed – Do check paper roll ERROR NO.: 0

If bit 1 is set, the 2313 will print:

Job specification error ERROR NO.: 18

and if bit 2 is set, the 2313 will print an Error No. other than 18 — refer to Error Code list.

A serial poll will clear this error condition if service request is enabled, otherwise a clearing by 〈DCL〉 or 〈SDC〉 has to be carried out (See Section 6.11).

Another method of polling the 2313 is the Parallel Poll. After the polling sequence is made by the system controller, a parallel poll will give the same information as bit 5 in the serial poll status byte. If an error is detected by Parallel Poll, a clearing by 〈DCL〉 or 〈SDC〉 must be carried out.

6.11. CLEARING THE 2313 VIA THE BUS

Device Clear 〈DCL〉 or Selected Device Clear 〈SDC〉

A Reset of the 2313 will be made clearing print buffer and job specification buffer as well as a running job. Stored memory files and interface functions will not be cleared.

Interface Clear 〈IFC〉

If the 2313 has been manually brought to the 'printer' mode, the 〈IFC〉 will cause both a Reset as for a 〈DCL〉 and a reset of the interface functions. The same will be the result if the 2313 is locked by an error while having the IEC control.

If the 2313 previously has been remotely operated without locking by errors, then only the interface functions will be reset.

If a job requires that the 2313 has control over the bus, an 〈IFC〉 must not occur until the 2313 has finished its job and has given the control back to the system controller in an orderly way except in the case of a locking error.

Note: To ensure that a job will be executed, it is necessary to wait a certain time between job specifications and while the 2313 is being cleared.

6.12. PRINTING WITH THE 2313/BZ 7004

The following procedure for printing data transferred over the interface bus applies when the 2313 is in its 'printer' (or listen only) mode. This can be achieved manually as outlined in Section 6.4.1 or by addressing the 2313 and sending the job specification PRINTER as described in Section 6.6.6. The 2313 will then be in its 'printer' mode, accepting ASCII characters sent over the interface bus and printing them out on receipt of 〈LF〉 (Line Feed), 〈EOI〉 (End Or Identify), or when the 2313's buffer is full. Characters are stored in sequence in the buffer and are printed out with automatic line feeds inserted in the case of overflow.

By sending the appropriate command, given overleaf, the ASCII printer format can be altered, or the 2313 brought into its graphic mode. The 2313 can be unaddressed to isolate it from interface bus activity, however when re-addressed, the 2313 will remain in its 'printer' mode. Deactivating the 'printer' mode is achieved by sending DEVICE CLEAR or SELECTED DEVICE CLEAR (see Section 6.11), or by manually activating any of the Reset levels (see Section 3.4).

The 2313 can print out all the non-control ISO characters as well as a range of special characters after receiving the ISO control character 〈SO〉 (see below). The range of control characters and their influence on the 2313 when in the 'printer' mode are listed below:

〈LF〉 Produces a line feed i.e. the current line is terminated and a new line started.

〈FF〉 Produces a form feed i.e. the current page is terminated and a new page started.

〈SO〉 The ISO characters between decimal 64 and 95 are replaced by special characters as shown in Table 6.6. This is maintained as long as the 2313 is in the 'printer' mode or until 〈SI〉 is sent.

〈SI〉 Returns the standard ISO character set if previously changed by sending 〈SO〉.

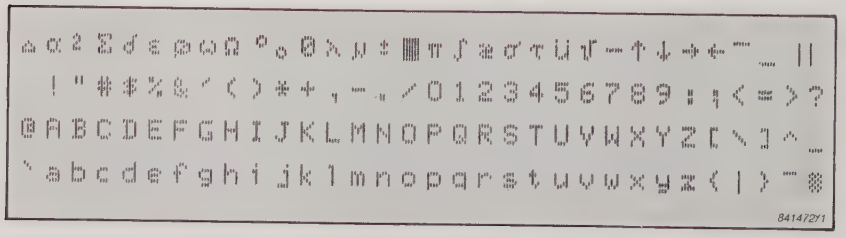
〈ESC〉 Notifies the 2313 of the start of a sequence, terminated by a ':', to change the printer format in 'printer' mode, or to access the graphic mode (see Sections 6.12.1 and 6.12.2).

The use of 〈SO〉, 〈SI〉 and 〈ESC〉 sequences conform to ISO 2022 (Code Extension Techniques).

Bit Numbers b_4 b_3 b_2 b_1	b_8 b_7 b_6 b_5 0 0 0 0	0 0 0 1	0 0 1 0	0 0 1 1	0 1 0 0	0 1 0 1	0 1 1 0	0 1 1 1
0 0 0 0	NUL	DLE	SP	0	@ Δ	P π	`	p
0 0 0 1	SOH	DC1	!	1	A α	Q ∫	a	q
0 0 1 0	STX	DC2	"	2	B ²	R æ	b	r
0 0 1 1	ETX	DC3	#	3	C Σ	S σ	c	s
0 1 0 0	EOT	DC4	$	4	D δ	T τ	d	t
0 1 0 1	ENQ	NAK	%	5	E €	U ü	e	u
0 1 1 0	ACK	SYN	&	6	F φ	V √	f	v
0 1 1 1	BEL	ETB	'	7	G ω	W –	g	w
1 0 0 0	BS	CAN	(	8	H Ω	X ↑	h	x
1 0 0 1	HT	EM	)	9	I ⁰	Y ↓	i	y
1 0 1 0	LF	SUB	*	:	J ⁰	Z →	j	z
1 0 1 1	VT	ESC	+	;	K Ø	[←	k	{
1 1 0 0	FF	FS	,	<	L λ	\ –	l	¦
1 1 0 1	CR	GS	-	=	M μ	] –	m	}
1 1 1 0	SO	RS	.	>	N ±	¯ ¦	n	~
1 1 1 1	SI	US	/	?	O ■	– ¦	o	DEL

T00079GB0

Table 6.6. Table of ASCII (ISO 646 equivalent) characters showing also the special characters available on the 2313



84147Z/1

Fig. 6.19. Sample print out from the 2313 showing the alphanumeric characters available

6.12.1. Changing the Printer Format in 'Printer' Mode

Each standard character occupies a space of 8 pixels high by 6 pixels wide. The character height, distance between characters, line spacing can be altered as well as adding an underline. Fig. 6.20 gives the syntax of the sequence used to alter the format. The character height is a number between 1 and 4 (default is 2), where 1 is 1/2 of the standard height, 3 is 3/2 times the standard height etc. The space between characters is between 0 and 5 pixels (default is 0). The space between lines is between 0 and 7 pixels (default is 2). The underline feature underlines the following line only and is cancelled on receipt of ⟨LF⟩.

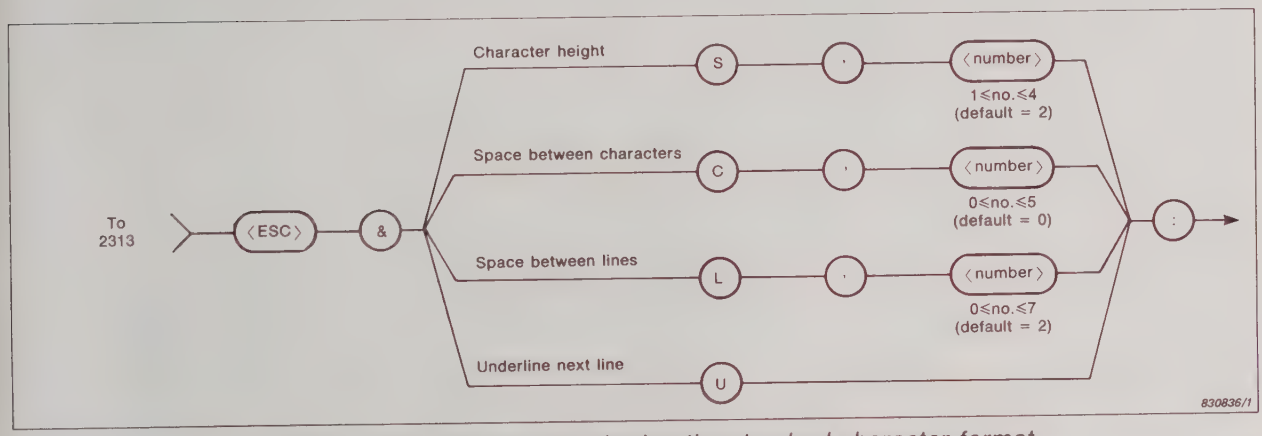


Fig. 6.20. Syntax diagram for altering the standard character format

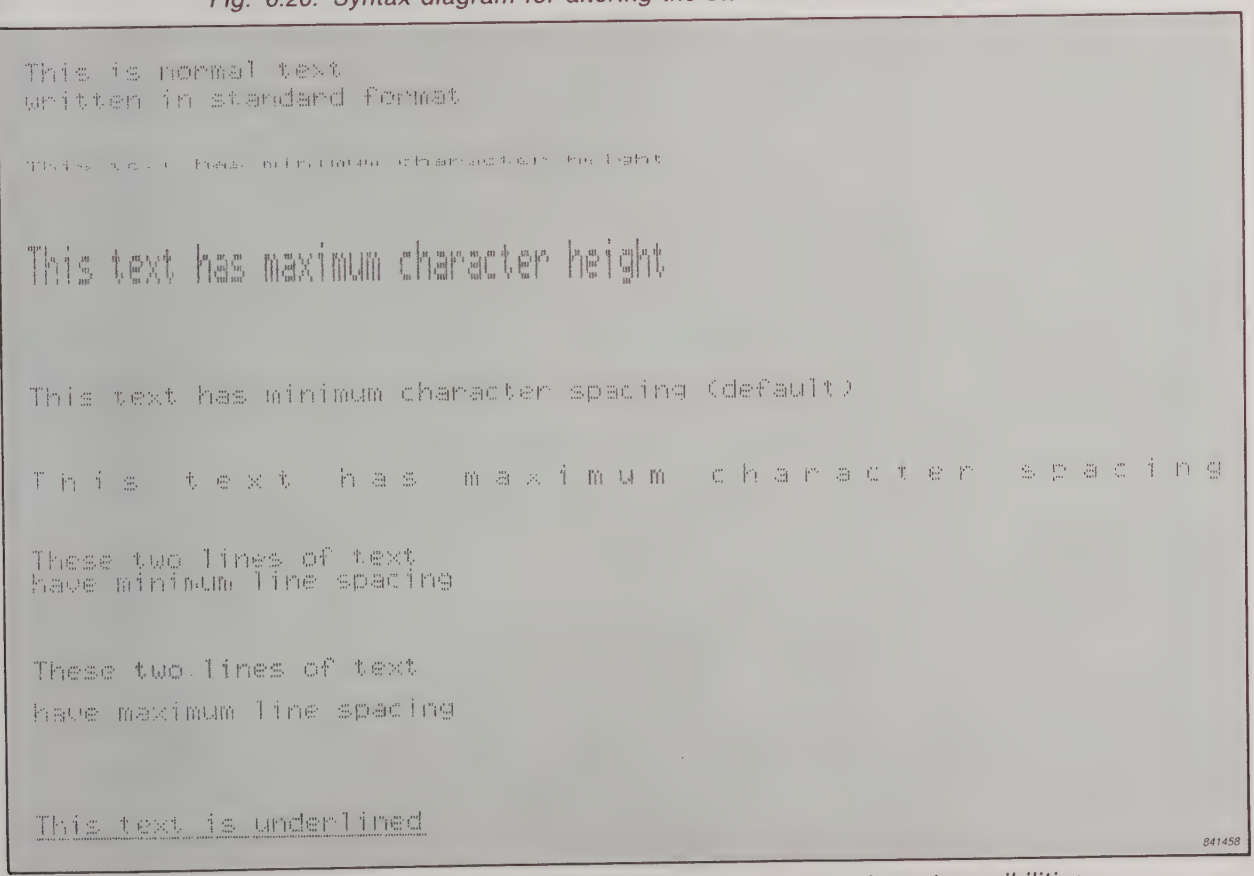

This is normal text
written in standard format
This text has maximum character height
This text has minimum character spacing (default)
T h i s t e x t h a s m a x i m u m c h a r a c t e r s p a c i n g
These two lines of text
have minimum line spacing
These two lines of text
have maximum line spacing
This text is underlined
841458

Fig. 6.21. Sample print out from the 2313 showing various format possibilities

6.12.2. Changing to Graphic Mode

In the graphic mode, the binary data sent to the 2313 activate the pixels directly. Fig. 6.23 gives the syntax used when printing in graphic mode with an example of the construction of one graphic line given in Fig. 6.22. This specifies what binary data follows this ⟨ESC⟩ sequence and it is important that the following data is as specified. On completion of the graphic print-out, the 2313 returns to the normal ASCII mode. At this point and not before, a further ⟨ESC⟩ sequence can be initiated. The number of graphic lines is from 1 to 999 (default of 1). The number of graphic bytes per line is from 1 to 64 (default of 64 which is one complete line). The Graphic line start point is from 0 to 63 (default is 0 i.e. start at first line). Fig. 6.24 gives an example of a program, written for demonstrating the graphic mode. An example of the print-out obtained from this program is given in Fig. 6.25.

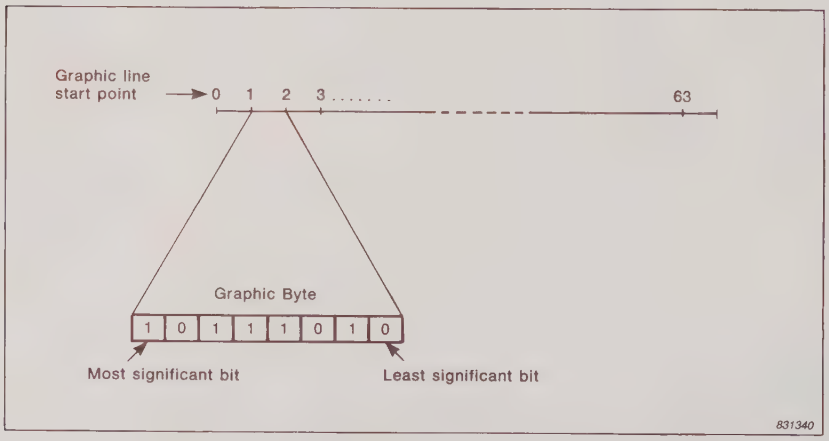


Fig. 6.22. Example of the construction of one graphic line

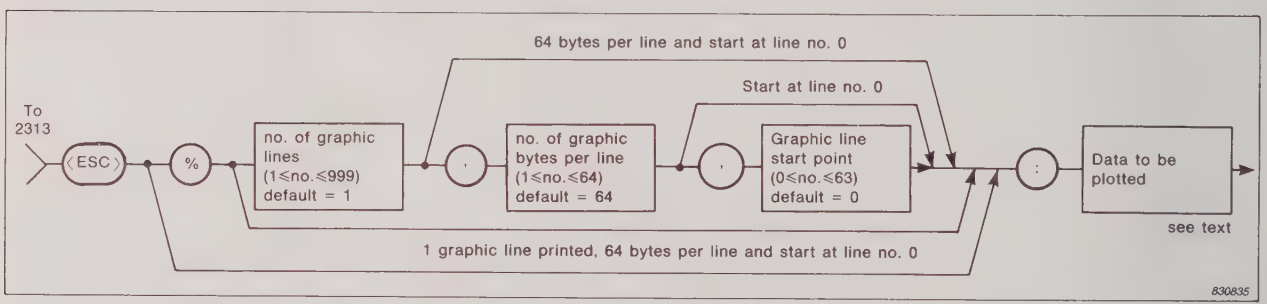


Fig. 6.23. Syntax diagram for plotting in the graphics mode

```
10    !
20    ! The following program reads in 30 values and generates a graphic
30    ! picture on the 2313 showing the values as a histogram.
40    !
50    ! The program is written on an HP 9826 with BASIC 2.0 System.
60    !
70    ! 2313 should be set to 'System Controller, Not Active' mode and the
80    ! address should be set to decimal 1.
90    !
100   !
110   COM Hist(1:30)                    ! The array 'Hist' is used for data.
120   INTEGER Pixel_array(0:200,1:30)
130   !
140   ! The array 'Pixel_array' is used to store 201 pixel-lines of 30 graphic
150   ! bytes (240 bits). Each graphic byte represents one channnel and is
160   ! stored as INTEGER's.
170   !
180   Min=1.E+9
190   Max=1.E-9
200   !
210   ! Read in data from keyboard:
220   !
230   FOR Ch=1 TO 30
240     DISP "VALUE CHANNEL";Ch;
250     INPUT Hist(Ch)
260     IF Hist(Ch)>Max THEN Max=Hist(Ch)  ! Find maximum
270     IF Hist(Ch)<Min THEN Min=Hist(Ch)  ! Find minimum
280   NEXT Ch
290   !
300   Range=Max-Min     ! Autoscaling
310   Plot_range=200    ! 200 pixel-lines are used for data
320   All_pixels=255    ! All 8 bits in one graphic byte is 1
330   No_pixels=0       ! All 8 bits in one graphic byte is 0
340   First_pixel=128   ! First bit (most significant bit) is 1
350   Last_pixel=1      ! Last bit (least significant bit) is 1
360   !
370   ! Generate the top frame line:
380   !
390   FOR Ch=1 TO 30
400     Pixel_array(200,Ch)=All_pixels  ! Set all  8 bits in the byte to 1
410   NEXT Ch
420   !
430   ! Generate the data lines from top to bottom:
440   !
450   FOR Line=199 TO 1 STEP -1
460     FOR Ch=1 TO 30
470     IF Hist(Ch)-Min>=(Plot_range-Line)/Plot_range*Range THEN
480       Pixel_array(Line,Ch)=All_pixels               ! Set all 8 bits to 1
490     ELSE
500       Pixel_array(Line,Ch)=No_pixels                ! Set all 8 bits to 0
510       IF Ch=1 THEN Pixel_array(Line,Ch)=First_pixel  ! Set left frame bit
520       IF Ch=30 THEN Pixel_array(Line,Ch)=Last_pixel  ! Set right frame bit
530     END IF
540     NEXT Ch
550   NEXT Line
560   !
570   ! Generate the bottom frame line:
580   !
590   FOR Ch=1 TO 30
600     Pixel_array(0,Ch)=All_pixels  ! Set all 8 bits in the byte to 1
610   NEXT Ch
620   !
630   CLEAR 701                       ! Clear 2313
635   WAIT .5                         ! Wait .5 seconds
640   OUTPUT 701;"PRINTER"              Set 2313 in printer-mode
650   OUTPUT 701;CHR$(10);CHR$(10)    ! Send 2 Line-Feeds
660   !
670   ! Print text:
680   !
690   OUTPUT 701;"                              RANGE:";Min;" -";Max
700   !
710   ! Dump the picture as 6030 bytes:
720   !
730   ! No. of lines: 201
740   ! No. of bytes per line: 30
750   ! Start point for all lines: 10
760   !
770   OUTPUT 701 USING "#,K,6030(B)";CHR$(27)&"%201,30,10:",Pixel_array(*)
780   !
790   !
800   ! Print text:
810   !
820   OUTPUT 701;CHR$(10);"             CH 8        10          20
0";CHR$(10);CHR$(10)
830   !
840   END
```

841460

Fig. 6.24. Example of a program to demonstrate the graphic mode of the 2313

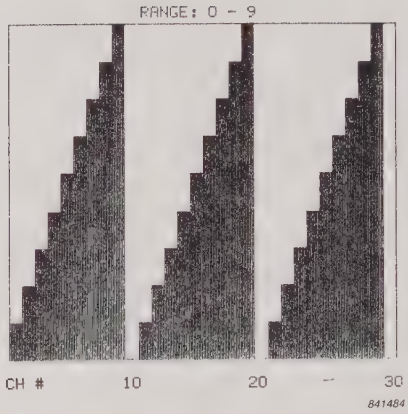


Fig. 6.25. Read-out obtained when running the program example in Fig. 6.24

7. THE SERIAL INTERFACE

7.1. INTRODUCTION

The Serial Interface in the 2313 conforms to the EIA Standard RS – 232 – C (equivalent to CCITT V 24). This standard ensures voltage level compatibility, identical pin wiring, and that certain control information supplied by one device can be understood by other devices. However, it is important to note that the interface may be used in various ways and that it is allowed to use more or less simple subsets of the standard.

To operate the interface is not only a matter of sending understandable data between the devices, but also to ensure that the device uses the number of control lines which is needed by the other device, that the number of bits and stop bits is correct and that the same baud rate, (data flow in bits per second), is selected in the two devices.

The following specifications apply to the Serial Interface of the 2313:

Number of bits: 8
Number of stop bits: 2
Parity: No
Mode of operation: Full duplex
Baud rate: 75 – 9600 Baud
Output level: ± 7 Volt nominal
Connector: 25-pin female
Syncronization method: None

The 2313 is coupled as a "Data Communication Equipment (DCE)" which is also called a modem. The device which is connected to the 2313 will normally be a "Data Terminal Equipment (DTE)" and have a 25-pin male connector. The baud rate may be selected up to 9600 baud, but in cases where a block of more characters are following rapidly after each other, it may be advisable to use a lower baud rate.

List of pins used:

1. Protective ground	connected for chassis
2. TDATA	Data **to** the 2313 (input)
3. RDATA	Data **from** the 2313 (output)
5. CTS	Clear to send (output)
6. DSR	Data set ready (output)
7. Signal Ground	Common return
8. DCD	Data carrier detect (output)
20. DTR	Data terminal ready (input)

The signals CTS, DSR and DCD are held true (high level) whenever the 2313 is turned on. The signal DTR is expected to be true but may in most cases be left unconnected. Consult the manual for the Data Terminal Equipment for possibly needed control signals.

7.1.1. Setting the 2313 Baud Rate

When a terminal is connected to the 2313 via its RS 232 interface and 'Reset' pressed, it is possible to insert personal text via the terminal or to remotely control the 2313. Before operating the terminal it may be necessary to set the baud rate to match that of the 2313 (factory set to 9600 bits/sec.). If necessary, the 2313 baud rate can be altered in factors of 2 from 9600 to 75 bits per second, by altering the jumper plug to a new position as shown in Fig. 7.1. The jumper plug is located on the printed circuit board on the inside of the back panel, accessible by removing the two screws securing the top panel and sliding the panel back. Ensure the mains power is disconnected before attempting to remove the top panel.

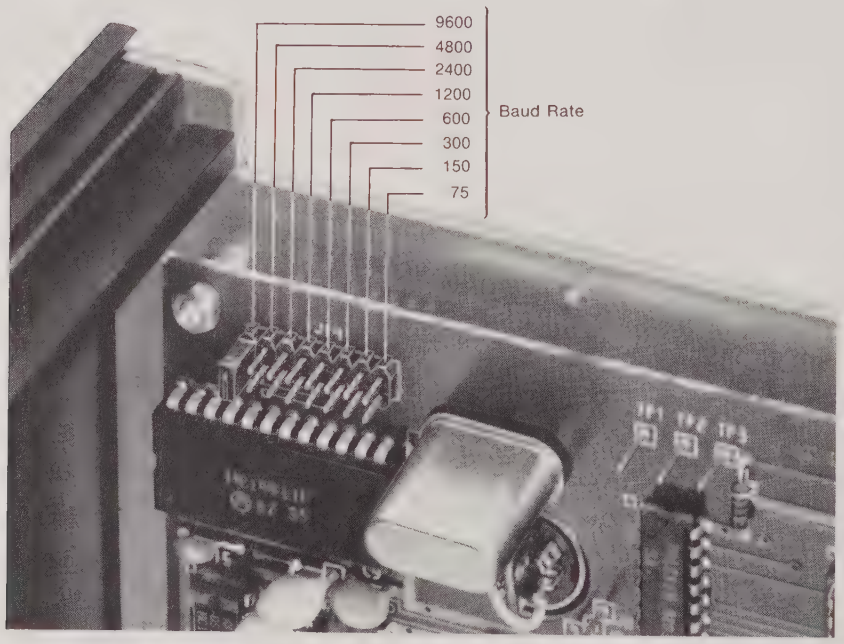


Fig. 7.1. Location of jumper plug for changing the baud rate

7.1.2. Personal Text

Prior to typing in the text, one of the textlines has to be selected then the characters can be typed in directly. Table 7.1 gives a list of the relevant cushkey commands.

Terminal	Result
G_c 0	select textline 0
G_c 1	Select textline 1
G_c 2	Select textline 2
G_c 3	Select textline 3
G_c 4	Select textline 4
G_c C	Clear selected textline and return to first character position
G_c T	Remote control of 2313 front panel, see Table 7.3
Another ASCII Control Character	A special character is put in the current position of the selected textline then incremented to the next character position, see Table 7.2
G_c + other ASCII character	Return to first character position in the selected textline
ASCII Character	The character is put in the current position of the selected textline then incremented to the next character position

Table 7.1. Remote terminal cushcution commands, where suffix c denotes a control character

In addition to the standard ISO characters, special characters can be entered from a list of control characters according to Table 7.2, e.g. N_c (Control N, equivalent to ISO control character SO) would give a ±.

Terminal	ISO	2313 Char.	Terminal	ISO	2313 Char.
$@_c$	NUL	1	P_c	DLE	┬
A_c	SOH	α	Q_c	DC1	┤
B_c	STX	2	R_c	DC2	≠
C_c	ETX	Σ	S_c	DC3	┴
D_c	EOT	δ	T_c	DC4	├
E_c	ENQ	ε	U_c	NAK	┘
F_c	ACK	σ	V_c	SYN	┌
H_c	BS	Ω	W_c	ETB	─
I_c	HT	α	X_c	CAN	┼
J_c	LF	α	Y_c	EM	┐
K_c	VT	Ø	Z_c	SUB	→
L_c	FF	λ	$[_c$	ESC	←
M_c	CR	μ	$\_c$	FS	↑
N_c	SO	±	$]_c$	GS	↓
O_c	SI	■	$\hat{}_c$	RS	
			$\__c$	US	

Table 7.2. Table of remote terminal commands for writing special characters in the textline, where suffix c denotes a control character

7.1.3. Remote Control of the 2313 Front Panel

It is possible to remotely activate the front panel pushkeys via the terminal. To set the terminal for remote operation, key in G_c (Control G, equivalent to ISO control character BEL) followed by 'T', thereafter the 2313 will be controlled by the terminal according to Table 7.3. Remote control will cease on pressing the letter 'O' on the terminal.

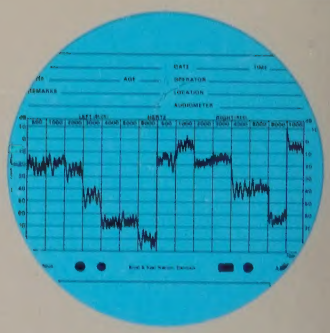
Terminal	2313 Front Panel	Terminal	2313 Front Panel
0	0	Y	Yes
1	1	E	E
2	2	N	No
3	3	/	/
4	4	W	Extension
5	5	C	Clear Entry
6	6	P	Page
7	7	H	Help
8	8	S	Setup
9	9	RETURN	Execute
–	–		
.	.	O	(cease remote control of 2313)

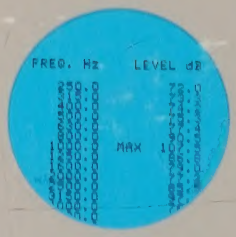
T00113GB0

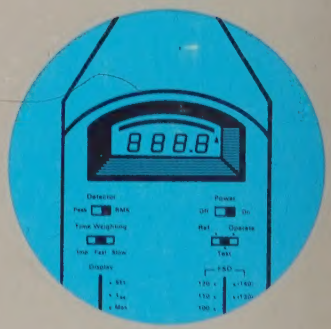
Table 7.3. Table of remote terminal commands for activating the 2313 front panel pushbuttons

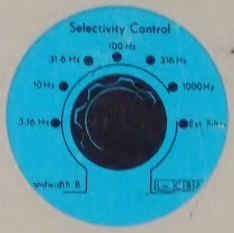
8. SERVICE AND REPAIR

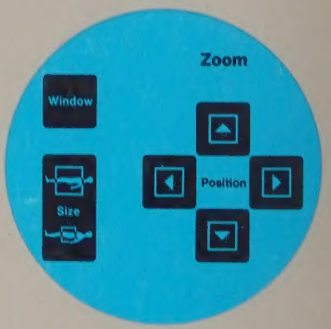
The 2313 is designed and constructed to provide the user with many years of safe, trouble-free operation. However, should a fault occur which impairs its correct function then it should be immediately disconnected at the mains source and secured against unintended operation. For repair consult the separate Service Instruction Manual available for the 2313 or contact your local B & K service representative. Under no circumstances should repair be attempted by persons not qualified in the service of electronic instrumentation.

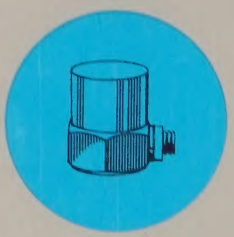


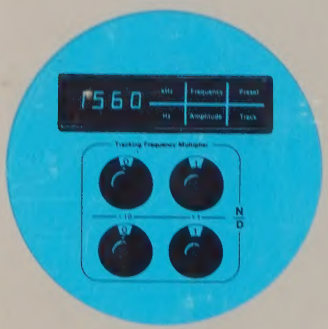


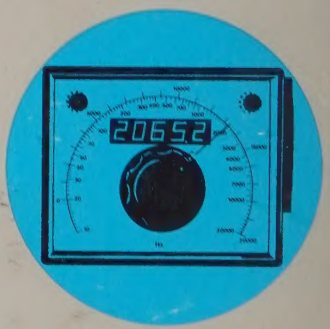


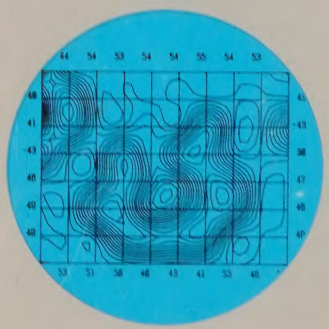


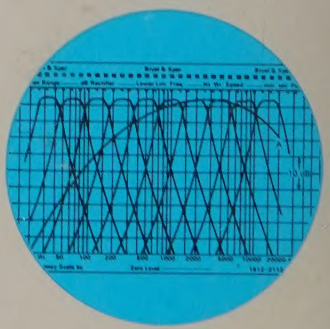












Brüel & Kjær DK-2850 NÆRUM, DENMARK · Telephone: + 45 2 800500 · Telex: 37316 bruka dk

Printed in Denmark by Nærum Offset